Food Manufacture
The Journal of the Food Industry

Vol. V. October, 1930 No. 10

In Praise of Canned Foods.

IT IS interesting to recall the tribute to canned foods paid by Sir William Willcox in the course of a lecture given by him in November, 1922, on the subject of "Food Poisoning," particularly in view of the fact that this eminent scientist had then been Scientific Adviser to the Home Office for more than twenty years. Sir William declared that he had never met with a case of food poisoning and that "*the danger of metallic poisoning from the eating of tinned foods is practically nil.*" He also asserted that the greatest experiment in history was the feeding of many millions of troops for years on tinned foods and that this was a marvellous example. Such testimony as this, from scientists, medical men, and others who are impartial and not financially interested in fostering sales, has done much to dissipate the remnants of ignorant prejudice and to assist in advancing canning to its present position of eminence amongst the food industries.

Pickle Surprise!

"The Surprising Story of Pickles" is the title of a radio talk recently broadcast from thirty-eight stations in the States. This was given by Mr. C. M. Walters, of Libby, McNeill, and Libby. Retailers have been encouraged to display pickle products prominently in their stores and windows immediately before and after this radio event. The Pickle Packing Association is expected in the near future to launch an extensive co-operative advertising campaign to educate the American public as to the many advantages of eating a greater quantity of pickles.

Cellulose Cans.

It is reported in *Food Industries* (Vol. II., p. 236) that progress is being made in the development of transparent cellulose cans from a material named "Hyguloid." This material is said to be odourless and flavourless. Cans with ends of enamelled tinplate are cut from seamless tubes of the "Hyguloid." The ends are double-seamed or crimped in the usual manner. Such cans are flexible, light in weight, and transparent. The cost of production is not yet definitely known.

Prevention of Discoloration.

Mr. Bohart, Assessor to the National Canners' Association, U.S.A. proposes (U.S.A. Patent No. 1699,274 [1929]) to apply zinc oxide or other insoluble oxide or phosphates which possess colourless sulphides as an internal coating of containers for canned foods. The material is applied by first incorporating the metallic oxide or salt into the baking lacquer, and the mixture is then applied to the container. This is an ingenious method of overcoming the development of objectionable colours on the internal surfaces of food containers due to the development of sulphides.

Canned Foods.

An important and highly interesting paper on the subject of canned foods was recently read before the East Midland Centre of the Sanitary Association by Mr. John N. Hughes, the inspector of meat, fish, and provisions at Nottingham. Reference was made to the advancements which have taken place in the food canning industry, to the saving of surplus food crops such as fruits and vegetables, the obliterating of seasonal crops, canning under scientific and hygienic conditions, the canning of tropical fruits with retention of flavour and nutrition qualities, and the examination and inspection of canned foods in general.

Recently much information has been adduced on the heat penetration in processing canned foods, and a study has been made of the heat resistance of those bacteria which are the most difficult to kill in pro-

cessing and which are known in the industry as spoilage bacteria. Tinplate has also been one of the major subjects of study in recent years, and it has been found that, in the case of fruits, the tin is anodic to the iron of the tin can. Fruits whose colours are anthocyan pigments (cherries and berries) are packed in enamelled cans to prevent bleaching. Although fruit acids have but little effect in corroding tin, the continued action of the acids and colours of the fruit is a matter of great importance, and the iron, having lost its protection, is able to set up local couples which result in hydrogen formation and eventually perforation.

Mr. Hughes dealt with the history of food preservation, the cooking and sterilising of various types of canned foods, and the classes of canned foods which may be rejected without hesitation, the latter including burst, blown, pierced cans, and jelly packed canned meats which do not solidify on cooling.

Kokusai Floating Cannery.

The Kokusai Kosen Gyogyo Kaisha was organised for the manufacture of canned crab, salmon, and trout, and salted fish and fish meal. It is stated that the company has now decided to produce principally fish meal, canned crab meat, and fish oil, and its products are to be marketed through Crosse and Blackwell.

The above company has purchased a floating cannery of 8,250 short tons at a price of 300,000 yen, but was unable to obtain trawlers for this spring season's fishing, and so has ordered three trawlers. The Koksai Floating Cannery Fish Company obtained fishing rights for six sections off Kamchatka, and, if business is satisfactory during this season, it is anticipated that they will erect a cannery and increase the number of boats in use for next season. The paid-up capital of the company was largely expended in the purchase of the floating cannery and trawlers.

Canadian Canning.

The total value of all the products of the Canadian canning industry in 1928 was $14,782,229, which represented an increase of $2,449,315 over that of the preceding year. The total cost of materials used in the fruit and vegetable canning section showed an increase of over 15 per cent. Of the import valuation, 65·4 per cent. of canned fruits and 70 per cent. of canned vegetables came from the United States. On the other hand, the U.K. took over 91 per cent. of the value of canned fruits and nearly 84 per cent. of canned vegetables exported during 1928. Detailed statistics showing the progressive development of the canning industry in Canada are published on p. 310 of *Canada* (September 6, 1930).

Food Colours.

In the *Am. Jour. Pharm.*, vol. 102, p. 329, Gallagher and Owen give a review of the history of the use of food colours and the laws governing them. This is followed by a list of the dyes approved by the U.S. Department of Agriculture, with their chemical composition, physical properties, and colour reactions with acids and alkalies. A scheme for dye separation and analysis is proposed.

Pineapple Peeling Machine.

A machine that, it is claimed, will peel a pineapple in fifteen seconds, and reduce spoilage from 20 to 15 per cent., has been devised and built by a San Juan, Porto Rico, machine shop.

The same organisation recently built a hand-operated coring machine for field use, to remove the core of the fruit before it is sent into the cannery. It will not be difficult, however, to add to the peeling machine an arrangement for coring and slicing, so that the whole operation can be performed at one time by a single operator.

Grading of Canned Products.

Under a scheme worked out by a canners' association in one of the Middle Western States, the pack of peas is to be graded by a board of selected canners and distributors who will be licensed by the State Department of Markets. It is claimed that a reduction of 58·4 per cent. will be effected in the number of varieties and sizes now in use, only fifteen varieties and grades being provided for under this new system. Within two weeks from the time of packing the packers are to submit sample cans of each lot that has gone through the factory, in the ratio of one can to each 100 cases. The uniform grading service will cost the canner one dollar per 1,000 cases, and may apply to his entire pack.

Grading will be on tenderness, flavour, clearness of liquor, freedom from defects and foreign matter, and uniformity of size and colour. The specifications for Grade "A" are that samples examined must have an official score of 90 points or better; Grade "B," 80 to 89 points; and Grade "C," 70 to 79 points.

The plan is claimed to represent an adaptation to the pea industry of the marketing methods employed with Californian and Floridan citrus fruits. Only one label is to be used, bearing the name of the State and the Product. Sub-titles will describe the grade as "Fancy," "Extra Standard," or "Standard," to indicate to the public why more is asked for a can of Grade "A" peas than for a can of Grade "B" or "C."

It is proposed to extend this grading service to include other products packed in the State in question, such as beans, beets, corn, and sauerkraut.

Corrosion of Containers.

According to the *Empire Marketing Board Report* (1929-1930, p. 24), a small canning laboratory has been established at the Low Temperature Station at Cambridge, the main purpose of which is to assist in the investigation of the corrosion of tinplate by foodstuffs. During the investigation of substances which accelerate or retard acid corrosion, a discovery of economic interest has been made. It was found that, though certain sugars definitely increased the rate of corrosion, a sample of refined English beet sugar definitely retarded it. Samples of refined beet sugar from most of the English factories exhibited this property, though in varying degrees. The property seems to belong, not to beet sugar itself, but to some unidentified substance present in the mother liquor. The economic interest of the discovery lies in the fact that there has been a tendency on the part of the canning industry to avoid beet sugar.

Packing Horse-meat.

Decision regarding the opening of the old Calgary abattoir as a horse-meat packing plant will be reached within the next few weeks, according to an American who has been interested for some time in a similar project in the United States. He will be joined shortly by another American, who will direct operations of the local company. The building in the north-east corner of the city, which was secured for this purpose some time ago, has been repaired and put in shape, and boilers and retorts have been installed for the preparation and curing of horse-meat.

It has been pointed out that plants of this kind have operated successfully at various points in the Western United States for a number of years. The meat is brine-cured and packed in tierces for shipment to a number of European countries, where horse-meat has long been used by certain classes of people as an article of diet. By-products of such a plant include canned dog feed, fox feed, ground bone, and horse hides.

It is felt by the officials of the company that the large number of inferior horses running on the range in sections of Alberta will enable such a plant to operate successfully for a considerable time. The company is negotiating with the railway companies in order to secure, if possible, a special freight rate on the horses shipped to the plant and on the export products to the seaboard, such as is in effect on certain American lines.

Vitamin C in Apples.

"An apple a day keeps the doctor away" was a slogan grandmother was proud of. To her apples were just apples, and she didn't bother too much about the variety. True, she preferred a Keswick with its long crease for cooking, because it jellied so well; but failing that she didn't despise a Scotch Bridget or any other variety of cooker that came along. She loved the red-cheeked Baldwin and the golden russet, but best of all for dessert the orange pippin took first place. Then came the Blenheims and the Worcester Pearmains; but all were apples, and good for you. Now science has turned its piercing gaze even on to the homely apple, and we find that, though all may be good, some are better. The Medical Research Council has been investigating the vitamin contents of various apples, and reports that Bramley's Seedlings are superior to any other apples so far as vitamin C is concerned, and neither heat nor cold damages this property. Now we can say in the true Sitwellian fashion: "Don't eat the golden pippin after dinner, Ambrose, in the quiet Sabbath eve, but gorge on a Bramley's Seedling, for that is the apple—yes, that is the apple for vitamin C."

To Bleach or Not to Bleach?

That is a question which has given food for thought to the milling industry for many years, and one which is now taking up a fresh significance in view of developments in our knowledge of the vitamins. The bleaching of flour is a practice which was started to meet the public demand for a very white flour and to enable the millers of this country to face intensive American competition. The colour, which is removed by bleaching (as generally practised), is that due to the carotin of the endosperm of the wheat, and it is generally accepted that the colour removal is due to oxidation. It has been suggested that in the case of chlorine bleaching it is due to the formation of a colourless chlorine derivative of carotin; but as bleaching is brought about by other oxidising agents, such as peroxides, which could provide no chlorine, it is likely that the oxidation theory is the correct one.

Until quite recently no one paid much attention to whether the carotin was destroyed or not, as it is present in such small quantities that it was never considered to have much food value. Now it seems fairly clear that there is some relation between carotin and vitamin A, and the whole problem needs careful consideration in view of recent researches.

Our Changing Food Supply.

It is interesting to note how our consumption of food has varied since pre-war days. In his presidential address to the Royal Statistical Society, Mr. A. W. Flux pointed out that, taken per "man," there is a decrease in fish and in poultry, eggs, etc., of nearly 3 per cent., an increase of 6½ per cent. in the aggregate of dairy produce, of 7 per cent. in the

aggregate of vegetables, of between 7 and 8 per cent. in the aggregate of sugar and sugared goods, and of well over 40 per cent. in fruit. The decrease in meat is 6 per cent. and in cereals 10 per cent. The supply per man of meat of all kinds has been reduced by 10 lbs. per annum to 159 lbs., that of cereals by 30 lbs. to 270 lbs., whilst fruit has increased from about 1½ lb. per week to about 2⅔ lbs. per week per man. Sugar and cereals are the chief contributors to the dependence on imports for carbohydrates, and carbohydrates contributed two-thirds of the energy value of the food imported in the pre-war period and three-fifths in the post-war period (1909-1913, and 1924-1928 respectively). The vegetable group (including potatoes) is the largest contributor to the home produced supply of carbohydrates. It is quite likely that the reduction in the consumption of meat and cereals is a relic of the forced economies in these articles during the war, when rationing compelled a reduced consumption and the avoidance of waste. Another factor may be the increased use of restaurants, where meat supplies can be handled more economically than in private establishments. The increase in fruit of 593 tons is largely imported, as the home production has only increased by 51 tons. This undoubtedly is connected with improved transport facilities and more efficient cold storage methods.

Carotin and Vitamin A.

First of all Euler, Euler and Hellstrom, found that carotin in a state of apparent purity possessed intense vitamin activity. This was confirmed by Moore, who suggested that carotin was provitamin A. Then Dulière, Morton, and Drummond in 1929 found that the activity of carotin diminished with purification, and the pure product was of negligible vitamin A potency. Early this year came a pronouncement from Hume and Smedley-Maclean that, in spite of the variations of opinion amongst experts, nobody has been able to divorce the biological activity from the pigment whilst the latter remained intact, but the possibility still remains that the pigment and the substance responsible for the activity are distinct substances so closely resembling one another as to defy separation by the methods as yet tried. Still more recently Bezssonoff has stated that all attempts to isolate an active preparation free from carotin have failed, and that the difficulty in separating vitamin A and carotin is not sufficient proof that they are identical. Neither is there any direct evidence to support Moore's view that carotin acts as a provitamin, though Capper has recently published work on the absorption spectra of carotin and cod liver oil, etc., which led him to conclude that either vitamin A can exist in at least two forms, only one of which absorbs strongly at 328 $\mu\mu$, or that carotin behaves as provitamin A.

The whole problem is complicated and confused, and the miller and baker must await further findings of the biochemist before attempting to decide whether to pander to the popular demand for a very white flour by bleaching or whether to leave it in its natural colour.

Patents for Foodstuffs.

The recent controversy relating to the taking out of medical patents brings one to a consideration of foodstuff patents, and some remarks by Ladus, of the Bureau of International Research of Harvard in *The International Protection of Industrial Property*, are of great interest. He states that in Bulgaria, Chile, Danzig, Denmark, Latvia, Rumania, and Switzerland inventions concerning articles of food as well as the processes for their production are unpatentable. In Chile, Rumania, and Switzerland beverages as well as foodstuffs are excepted. In Austria, Czecho-Slovakia, Esthonia, Finland, Germany, Hungary, Japan, Luxembourg, Norway, Poland, Sweden, and Soviet Russia only inventions concerning articles of food as such cannot be patented, whilst the processes for the production of such articles are patentable. In Hungary the exception extends to articles of food for animals, and in Japan beverages and stimulants also are excepted. In Italy, in the case of inventions relating to beverages or eatables, the Superior Board of Health gives its advice before a patent may be granted. Whilst such restrictions may protect the public to some extent from monopolies of necessary articles, they certainly deprive the discoverer of special foods and drinks of the just reward for his labours and protection from copying by his competitors in business.

Origin of the Vitamin.

An interesting point which arises if carotin is really provitamin A or rich in vitamin A is the difference in carotin content of different wheats. Australian flour is much yellower than English flour, due to a higher carotin content, and therefore presumably has a higher vitamin A content. Why is this? Is it related to the sunshine to which the plants are subjected during growth? Is it connected with the amount of natural moisture present in the wheat, or is there some difference in the soils in which the wheats are grown? Too little is known of the origin of the vitamins, but one at any rate is known to be a product of ultra-violet light, and the sunlight theory may not be far-fetched. One thing is certain, the vitamins play a very important part in animal nutrition, and every fresh development and discovery in this interesting field should be studied carefully and critically by all food manufacturers.

FIG. 1.—Vat Cooker with an Air Lift.

Developments in Food Processing Machinery

By E. M. MRAK AND M. A. JOSLYN,
Fruit Products Laboratory, University of California.

This article has been specially written for FOOD MANUFACTURE *by two eminent American authorities. It gives a detailed account of the development of the modern, efficient processing plant used in American factories.*

COMPETITION IN the food canning industry is very keen because of the elements that enter into it. Canned foods are no longer regarded as a luxury; to-day they have become a strict necessity. Whereas in previous years the zealously guarded formula or recipe proved to be the chief bone of contention, at present canners have entered into friendly rivalry along the lines of quality in canned foods and cost of production. With the advent of trade association, canners have learned that what will help one will help the whole industry, and there has been less secrecy in the trade than before. Of course, even now, the introduction of a food novelty will create a fad for the moment, but, in the long run, competition in the industry is based upon giving the consumer the maximum of quality at the minimum of cost. The introduction of specialised canning machinery and the elimination of much hand labour by mechanical contrivances had much to do in recent years with the standardisation of the cost of canned foods. Where the cost of labour in preparing foods was high and the cost of the raw material was low, the use of even relatively inefficient mechanical or automatic systems paid a dividend. Such is not the case where the cost of the raw material is high and where mechanical handling results in a much lower yield. In view of the rising costs on even such raw materials as fruits and vegetables, efficient mechanical handling becomes, under the present competitive conditions in the industry, almost a necessity. Obsolete units are being replaced with newer, more modern and efficient units. In addition to the initial cost, the large overhead charges commonly occurring in canning plants operating on seasonal products have been the chief hindrance to the modernisation of many existing plants. However, the tendency at present is to extend the packing season, at least for fruits, by handling a greater diversity of products or by the use of proper methods of storage of the raw material later to be manufactured into finished products—*e.g.*, by freezing storage—and thus bring the overhead costs to a minimum.

The most important single operation in the manufacture of canned foods is the processing of the food so that it will be palatable and keep. It is not the object of this article to discuss the well-known fundamental principles underlying processing, but merely to present the steps in the evolution of the modern, efficient processing equipment. To decrease the cost of production it is necessary to handle the canned foods with the greatest speed compatible with thorough sterilisation and with the minimum injury to the cans. Besides being unsightly and making labelling difficult, nicks and dents in the can may result in a more rapid spoiling of the product.

The most important general steps in the evolution of the processing equipment used are discussed. In this outline, the equipment used for the sterilisation of foods, such as fruits, at temperatures up to 212° F. is differentiated from that used for foods such as meats, fish, and vegetables, which are generally processed at temperatures around 240 to 260° F.

Processing Equipment for use at Atmospheric Pressures.

1. Discontinuous, direct fired water cooker.
2. Discontinuous, steam heated water cooker.

3. Continuous, steam heated water cooker.
4. Continuous, agitating steam heated water cooker.

Processing Equipment for use at Higher Temperatures.

1. Open, direct fired, discontinuous cookers, using oil or water saturated with salt or calcium chloride.
2. Closed, direct fired water cookers.
3. Steam heated discontinuous, non-agitating retorts.
4. Steam heated discontinuous, agitating retorts.
5. Steam heated continuous, non-agitating retorts.
6. Steam heated continuous agitating retorts.
7. Retorts built to operate on air pressures in addition to steam pressure for glass and large tin cans

Discontinuous, Direct Fired Water Cooker.

Cookers of this type were probably the first to be used and were generally large cast-iron kettles filled with water, mounted on stone or bricks in such a manner that a fire could be built under them. The cans were placed in and removed from the kettle in a wire basket suspended from the end of a long, centrally swivelled pole. A counterpoise attached to the opposite end of the pole assured a more ready manipulation of the load.

Obviously, this type of cooker had a great many disadvantages. In the first place, the cooking resulted in a very unstandardised pack. Some cans were over-cooked when near the bottom of the kettle, whereas others were under-cooked when the fire died away. Very often the boiling lowered the water level sufficiently to cause some of the cans in the kettle to be exposed. These cans were usually under-cooked. An operator kept the fire going by feeding in wood or coal periodically. The operator sometimes forgot to replenish the fire and the cans were then under-processed. The use of these directly heated kettles necessitated a great deal of hand operation, which greatly retarded production. The cans were stacked into and removed from the cooking baskets by hand, which was not only time-consuming, but costly. Since the cans were handled individually, a higher percentage of them was damaged than is the case to-day. However, this handling of the individual cans was not excessive in view of the type of cans used at that time. The solder top cans used before the advent of the modern sanitary double-seam can required much handling.

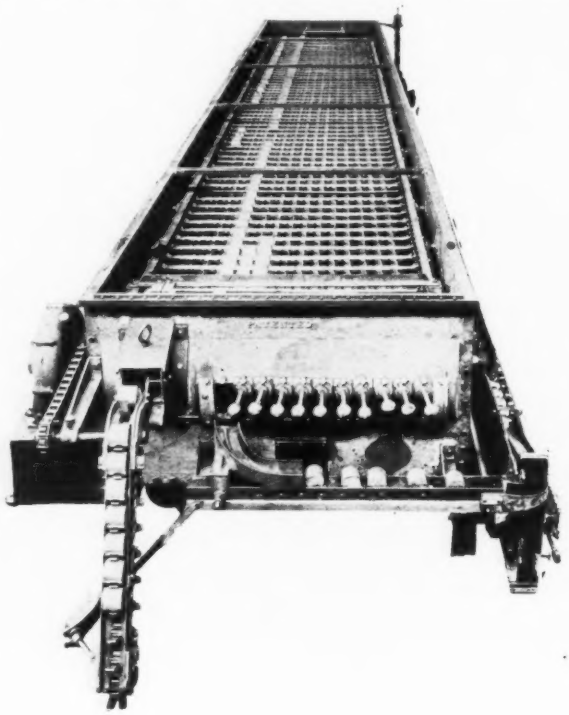


FIG. 2.—The Wonder Cooker.

Discontinuous, Steam Heated Water Cookers.

These cookers were found in canneries about fifteen years ago, and most present-day canners still have several of them located in some corner of the cannery. They are vats about 2 feet by 3 feet by 4 feet in size and are usually made of wood, brick, iron, or concrete (see Fig. 1). At the bottom of each vat is a perforated, forked ½ to ¾ inch steam-inlet pipe used to heat the water. The usual cannery arrangement is 8 or 10 vats in a row, one of the end vats being used as a cooling tank. Since the dimensions of the vats vary with different canners, each canner has a set of crates to fit his vats. If crate trays are used they are built to fit. The cans are stacked directly into the crates or in cooker trays which are stacked in the crate. Loaded crates hold approximately 7 to 10 dozen 10-cans, 10 to 20 dozen 2½-cans, and 25 to 35 dozen 1-flats. When the crates are loaded they are trucked to the end of the line of vats and lifted from the truck by means of a compressed air hoist, carried over the vat to be used and then lowered into the boiling water. Before the development of compressed air hoists, hand operated windlasses were used by canners. When the loaded crate is in the boiling water, the operator records on a dial board placed at the end of the vat the time at which the cans should be taken out. At the end of the cooking period the crate is lifted from the vat and carried over a cooling vat, into which it is lowered and held for about 3 minutes. It is then removed, placed on a truck and taken to the cooling porch, where the cans are put into wooden warehouse trays.

The vat type of cooker has some advantages, in that it will take care of any size of container for any period of time. They can be used for other purposes than cooking, such as heating water, washing equipment, etc. Most present-day canners have steam heated vat cookers in their plants in order to take care of odd size cans, cans requiring unusual cooks, and to have a place to wash their fruit boxes, etc.

This system also has its disadvantages. Vat cookers consume a great deal of steam, and for that reason are expensive to operate. The amount of labour required to load and unload the crates and to take care of the actual cooking is comparatively large. The number of dents and damaged cans resulting from handling is large. Owing to carelessness or negligence on the part of the operator, which may be partly due to the general confusion in

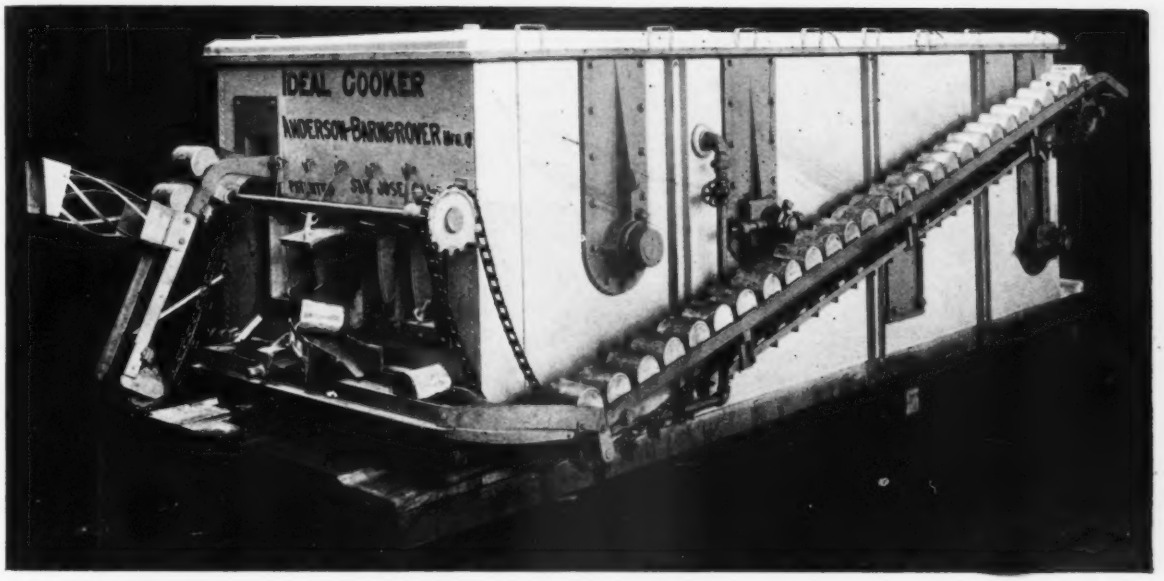


FIG. 3.—The Ideal Cooker.

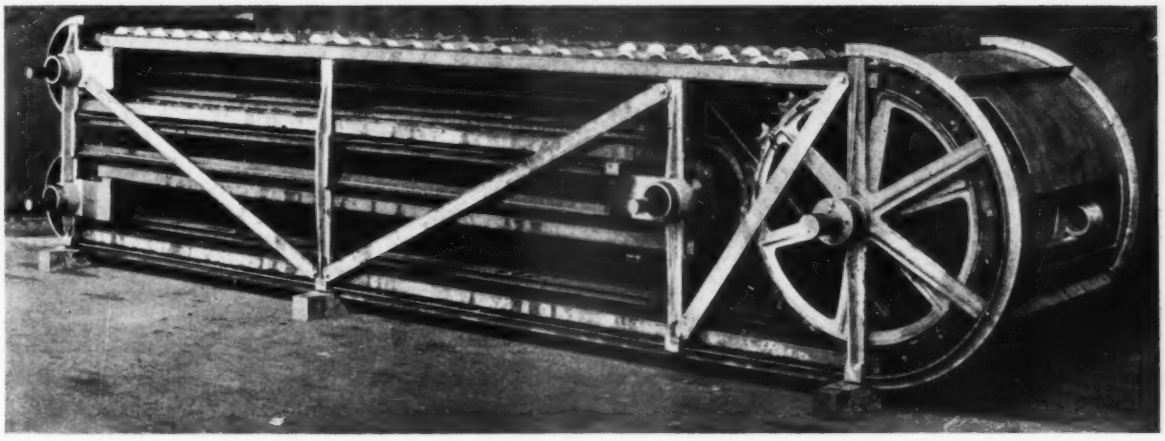


FIG. 4.—Interior of the Ideal Cooker.

the busy season, batches of cans are very often over or under cooked.

Continuous, Steam Heated Water Cookers.

The aim of manufacturers of canning machinery has always been to produce equipment that would increase plant efficiency and production and the quality of the pack. Since cook rooms in which vats were used had always been the centre of congestion, inefficiency, and the source of a large number of dented cans, early attempts were made to produce a high-speed mechanical cooker that would not injure the cans. Probably the first development in a mechanical cooker was an endless iron chain conveyor which carried the cans through a tunnel of boiling water. In the cookers of this type, such as the Dixon, the processing time is regulated by the speed at which the conveyor is operated. Some conveyors are arranged to carry cooker trays filled with cans, whereas others are arranged to carry cans placed end to end across the conveyor, about ten 2½-cans in each row.

These cookers are usually very long and require a great deal of floor space and are expensive to operate, as they require an abundance of steam for heating. They have the advantage of being able to take care of any size of container.

A continuous, steam heated water cooker having a more direct feed was developed in 1912 by the Baker-Shippee Company. This Wonder cooker is shorter, more compact, enclosed, and much faster and more economical to operate than the Dixon cooker. The cans are fed in automatically directly from the double-seamer or by hand. In the cooker the cans enter into an atmosphere of steam and are

carried across and downward into boiling water from one end of the cooker to the other. Cooking time is controlled by the operating speed of the machine and the variable outlets at the discharge end, which are shown in front in Fig. 2.

This cooker proved to be very popular when introduced, and for several years afterwards. It was purchased by the Anderson-Barngrover Company in 1916 and manufactured by them for several years. However, it was gradually replaced by the Anderson-Barngrover continuous, agitating, variable discharge cooker.

In 1916 the Anderson-Barngrover Company developed the Ideal cooker, operating on a very similar principle, to compete with the Wonder cooker. The Ideal was much shorter, as it had an inner fold to the track (see Figs. 3 and 4). At the close of the 1916 season, the Wonder cooker was purchased and the manufacture of the Ideal cookers discontinued. Several of the Ideal cookers were installed in 1916, and all but one of them are still in operation and giving good service.

Continuous, Agitating Cookers.

Agitation of the cans during processing is desirable because it increases the rate of heat penetration into the product, assures a more uniform heat penetration, and, by decreasing the time taken by the contents of the can to reach an effective cooking temperature, decreases the time of processing. In an agitating type of cooker most products can be safely processed in much less time than is possible with the batch method, thus resulting in an improvement in the product. Many manufacturers have striven unsuccessfully to develop a satisfactory cooker of this type, but it remained for the Anderson-Barngrover Company to develop the first successful cooker of this type.

In the year 1912 the Anderson-Barngrover Company produced the A.-B. variable inlet type cooker, the first successful continuous water and steam agitating cooker. The cans were conveyed to the cooker on a belt conveyor. The can-carrying unit in the cooker is of the reel and spiral type, the outer member being formed in a spiral path and held stationary and in perfect alignment by substantial angles, which in turn are secured to the tank; while the inner member or reel is made to revolve slowly and advance the cans through the spiral path, each can in a separate pocket, and all cans travelling their length with each revolution of the can-carrying reel. The cans were agitated while revolving in their progress over this spiral path (see Figs. 6 and 7). The time of cook was controlled by the use of a variable inlet. In 1913 the feed was changed to a more satisfactory chain conveyor (see Fig. 8). Commercial production of the chain feed variable inlet was started in 1913, during which year a large number of them were installed in canneries. The first year of commercial trial was so successful that they became generally accepted by canners in 1914. In 1914, the cooking time control system was changed from the variable inlet to a variable outlet (see Fig. 9). A number of outlet doors were built into the side of the cookers about 12 inches above the base of the cooker. The water level in the cooker was only up to the lower lever of the door. The space in the cooker above the water was filled with plain steam. In this type of machine the cook is determined, not by regulating the speed at which the machine is driven, which always remains the same, but by the door at which the cans are allowed to discharge. The variable outlet steam and water agitating cooker has been the standard of canning cookers from 1914 until very recently, when the round shell agitating cooker was developed. This cooker is built to take the cans direct from the closing machine and handle the capacity of a line. To prevent interruption a patented safety feed device was installed, in 1915, which will throw out any cans that are improperly fed to the machine.

The Round Shell Agitating Cooker* (see Fig. 10).

Since the can-carrying reel and spiral was roughly circular in cross section, its installation in a square tank allowed unused steam and hot water to accumulate in corners. To reduce this unused steam and hot water to a minimum the A.-B. Manufacturing Company had contemplated for some time the manufacture

* E. W. Thomas, "Speed with Quality," *Cannery Notes*, **15**, April, 1928, pp. 15-28.

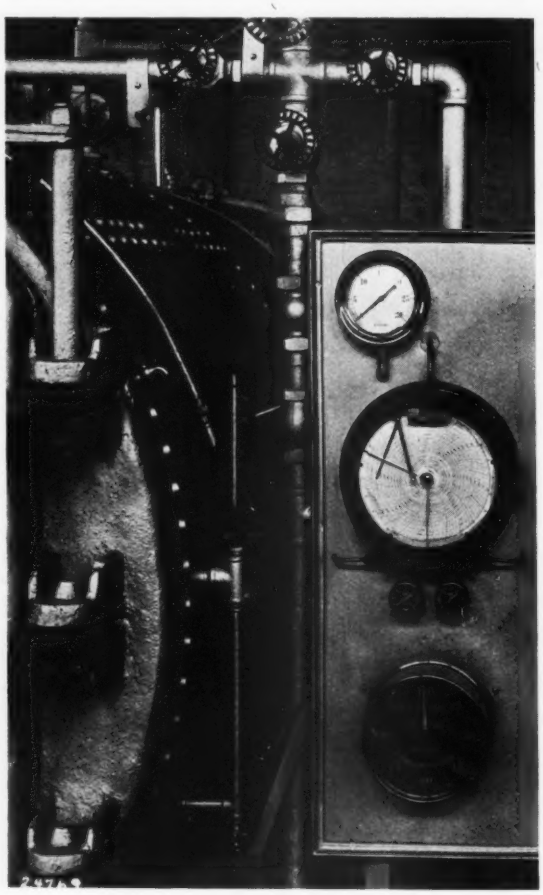


FIG. 5.—An Instrument Board in a Cannery.

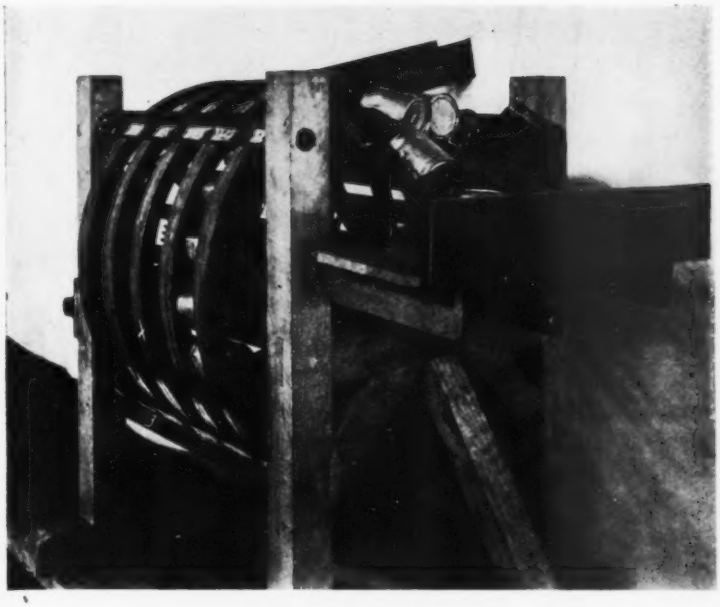


FIG. 6.—Model of Reel and Spiral built in 1912.

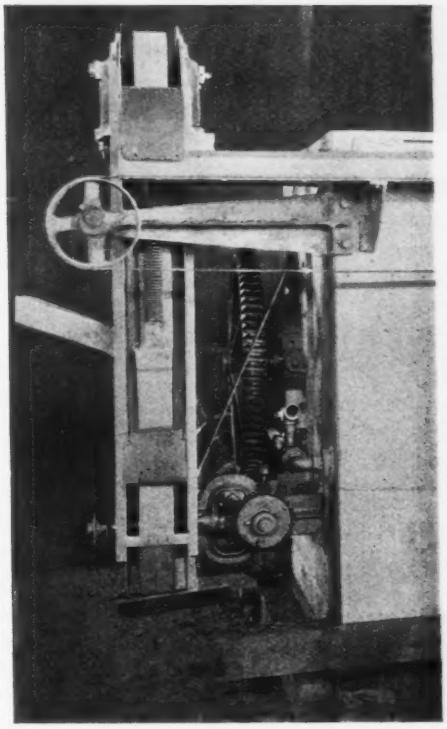


FIG. 7.—An Early Variable Inlet Cooker.

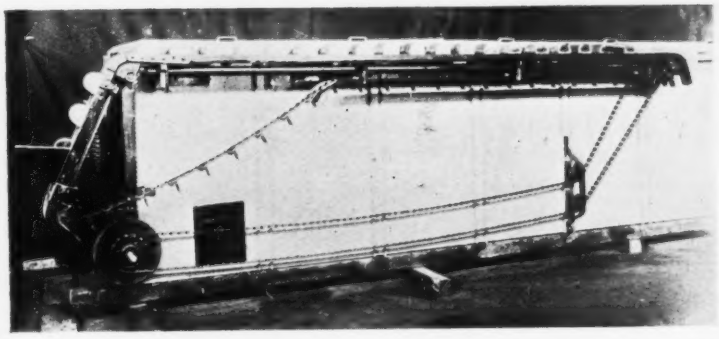


FIG. 8.—Variable Inlet Chain Conveyor Cooker built in 1913.

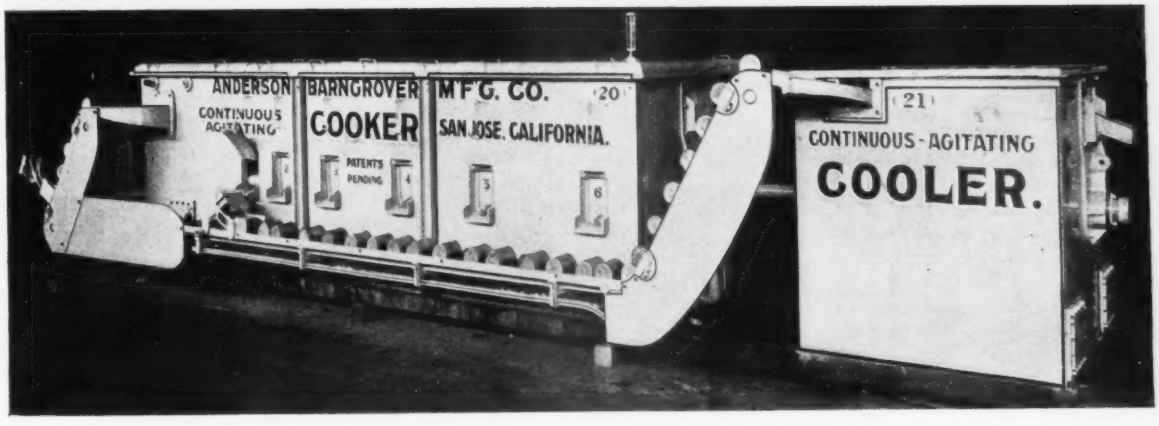


FIG. 9.—Variable Discharge Cooker built in 1914.

of a round shell cooker. In view of the general satisfaction accorded the previous machines, they hesitated a long time before making any great changes in their cookers. A new shell shop was finally designed by the A.-B. Company which combines the desirable features of both the square and the round shell types. The advantages of this type of cooker are: That but little steam is wasted; it has a greater variation in time of cook, as the feed inlets are so designed that they can be installed at every alternate turn of the spiral; it is well adapted to high speed of operation and is equipped with a special overhead feed, leaving a clear isle between the closing machine and cookers. In its construction care is taken to move the cans with the greatest possible speed with the minimum injury to the can itself. The type of elevator used, the short space between the side conveyor and cooker, the absence of attachment links in the can conveyor chain, the unique method of transferring from cooker to cooler, and the means provided for keeping the tank bottom clear of obstruction, assist in preventing damage to the cans.

The loss of steam in this cooker is reduced to a minimum, as it is provided with close-fitting doors for all feed openings; the can extractor is housed in and hooded down to the conveyor, forming a trap to prevent the escape of steam, and the excess openings at the top are provided with suitable water seal covers. In addition to these marked improvements, the A.-B. Company has again returned to the use of the variable inlet to control the time of cook.

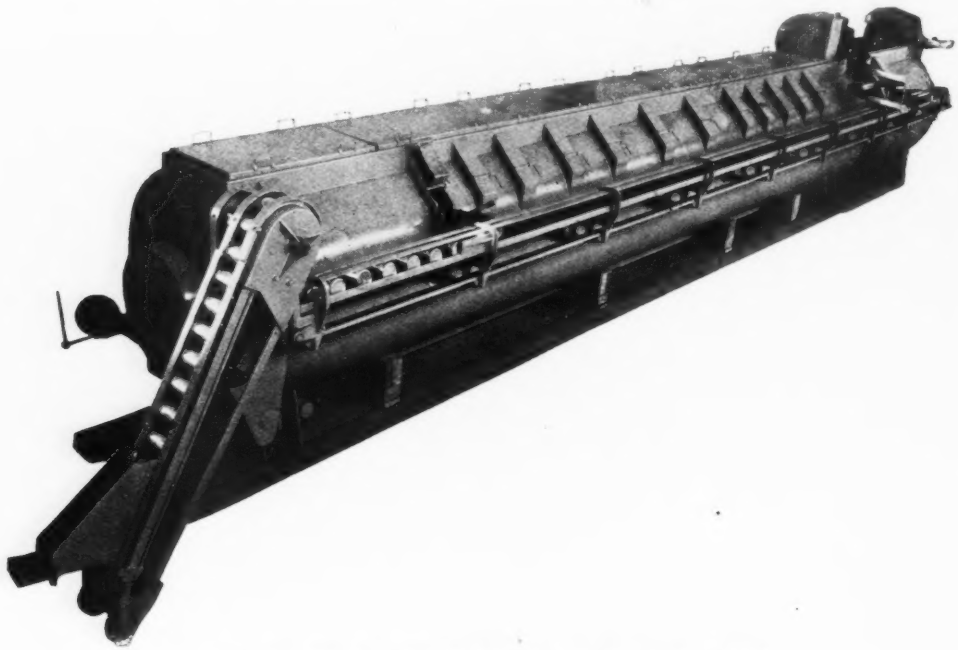


FIG. 10.—The Round Shell Agitating Cooker built in 1928.

High Temperature Cookers or Retorts.

1. Probably the first type of equipment used for processing foods at temperatures above the boiling point of water was of the open, direct fired discontinuous type, using oil or water saturated with salt or calcium chloride. It was difficult to clean the cans cooked in oil, and they presented an unsightly, gummy, sticky appearance. The stench of heated oil made quite a nuisance of the processing or cook room. The use of saturated brines was not satisfactory because of injury not only to the cans, but also to the processing equipment. The method was wasteful, and salt was hard on equipment, and satisfactory temperature control could not be obtained. In many cases the necessary temperatures were not reached. The many disadvantages of such a cooker are too obvious for enumeration.

2. Direct heated closed water cookers. Equipment of this type which was early used was probably the first approach to the utilisation of steam under pressure for the production of temperatures above 212° F. The cooker, which was so built that an open fire could be maintained under it, was partly filled with water, a batch of cans in a wire basket placed in it, the top was firmly clamped on and the fire was started. As often happened, there was a great variation in the intensity of flame and the duration the fire was maintained. Probably in many cases the time of processing was controlled to a great degree by the time the fire was maintained under the retort.

3. Discontinuous, non-agitating steam heated retorts. The first commercially successful pressure cooker or retort depended upon the use of steam under pressure. Many of these retorts are still in use and when steam is admitted properly, and the retort thoroughly vented, they are entirely satisfactory for all packed foods with the exception of those in glass and in larger-sized cans. The latter require additional air pressure for proper operation. This type of retort has the disadvantages of any batch-type

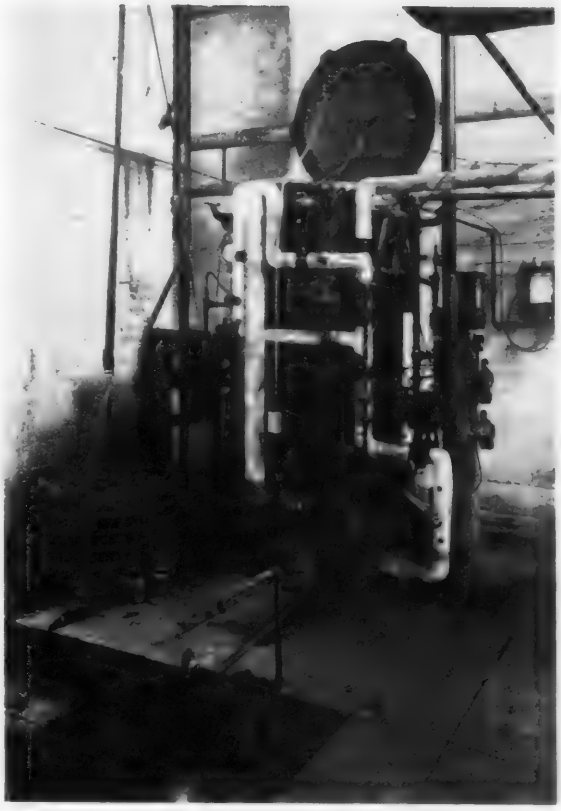


FIG. 11.—Vertical Retort with Thermocouple attached for Heat Penetration Studies.

FIG. 12.—An Early Type of Horizontal Retort.

FIG. 13.—Tubular Horizontal Retorts.

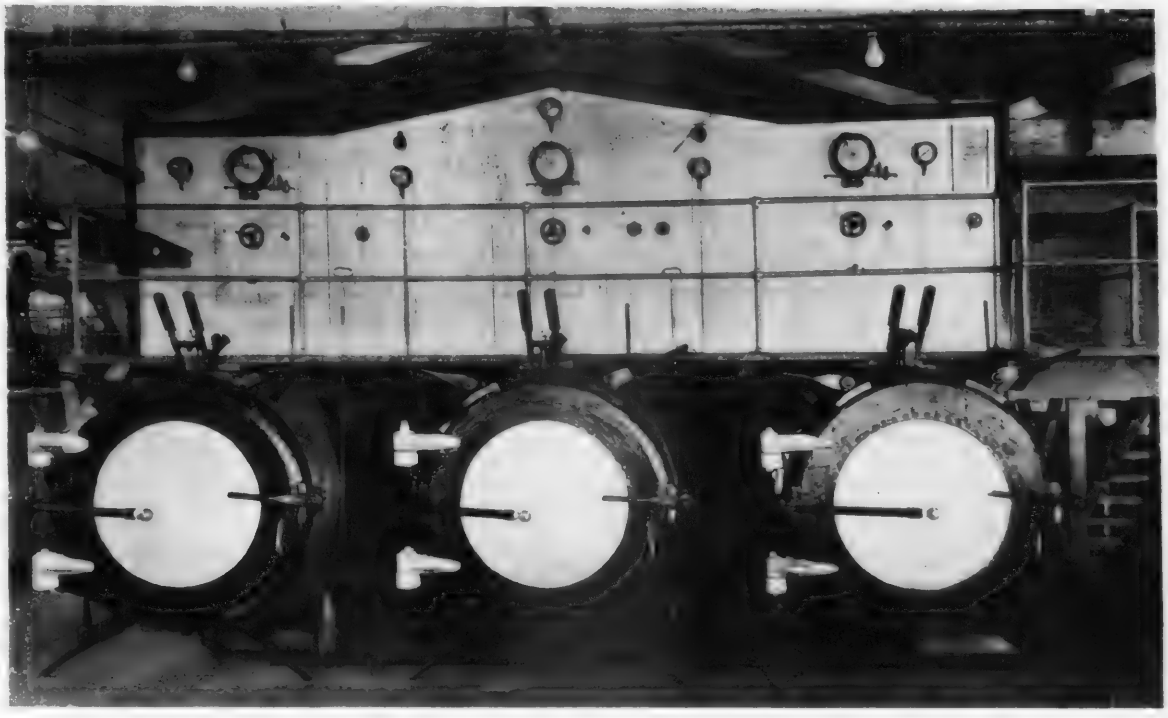


FIG. 14.—A Recent Installation of Horizontal Retorts at Mayfield, California.

cooker, and what was true of the vat-type cooker is true of this.

Two types of retorts are used, the vertical type used in the Eastern States and the horizontal type developed in California. In the vertical type the retort is loaded by means of an overhead crane handling baskets of trayed cans, and the horizontal type by means of trucks on rails. Generally, they are built of sufficient size to contain three baskets or five to six trucks (see Figs. 11, 12, 13, 14).

Discontinuous, Agitating Steam Heated Retorts.

Early in the investigations on heat penetration carried out by the National Canners' Association it was found that agitation of the contents of the can greatly increased the rate of heat penetration, thus making it possible to shorten the time of cook. This is more pronounced in the case of products so packed that the contents of the can act as baffle plates to produce irregular turbulent motion in the can when rotated rather than a swirling motion. Where agitation assists in securing a more uniform heat penetration the use of agitating retorts is of great value in shortening the time of cook. However, retorts of this type are not very prevalent, due to mechanical difficulties encountered and to the introduction at about the same time of the continuous retorts.

Continuous, Steam Heated Agitating and Non-Agitating Retorts.

A continuous pressure cooker or retort has long been the dream of the canner. The mechanical difficulties involved have baffled engineers for years. The problem was finally solved by the development of the A.-B. combined pressure cooker and cooler. This cooker and cooler is of the reel and spiral type that was successfully used by Anderson-Barngrover in the standard open cooker, and is enclosed in a shell of heavy boiler plate and provided with a steam-tight intake and discharge valve, and a valve between the cooker and cooler so that cans may be transferred from cooker to cooler without loss of pressure (see Figs. 15, 16, 17). The first machine built of the present type has been in successful use since 1920, and retorts of this type are now being used for handling a great variety of products.

The agitation received by the product due to the rolling action of the cans as they travel through the continuous cooker is of decided advantage with most products, making it possible by increasing the rate of heat penetration to shorten the time of cook. There are, however, certain products that will not stand much agitation while being processed, and for handling such products the continuous method with the minimum amount of agitation gives the best results. To handle such products there has been recently designed and built by the A.-B. Company a special non-agitating reel, in which the cans are carried at all times, and not allowed to roll upon their own axes, thus only receiving the gentle agitation caused by the slowly revolving can-carrying reel.

Retorts for Glass and Large Tin Cans.

In processing foods packed in glass containers or No. 10 or larger cans it is desirable, and necessary in the case of glass, to maintain a superimposed pressure above the normal steam pressure for the purpose of counteracting the internal pressure of the containers and relieving the strain on the seams of the large tin containers and the caps on glass jars. Air under pressure is chiefly used for this purpose, as it is convenient to use and satisfactory if handled properly.

Two general methods of retort operation wherein air is used to maintain a suitable pressure are: (*a*) Steam and air; and (*b*) water cooks with air pressure. In the first method, air pressure is built up by the expansion of the air trapped in tightly sealed retorts upon heating by steam or by the introduction of air with the steam. The air and steam system has been found to give non-uniform temperatures in the retort during the "come up" or heating period. This is especially true of the loaded retort. The water-cook method which is used in California has been found to give more uniform heating. Non-uniform heating in the retort is unsatisfactory, as all of the cans in a given batch may not receive the necessary cook at the time and temperature desired.

Temperature Indicators in Processing Equipment.

As a result of recent research on heat penetration in various foods under different conditions and death temperature of bacteria commonly found in these foods, coupled with actual tests under cannery conditions, the time and temperature of sterilising most foods is fairly definitely known. To assure that the food product has received the necessary process it is necessary to know the temperature at which the food was processed and the time during which the food was exposed to that temperature. This information is of greater importance in the case of foods which are processed at temperatures above 212° F.

Originally, and in some cases at present, the retorts were not furnished with any method of direct measurement of temperature, such as the thermometer. Nor were these methods used. Each retort was furnished with a safety valve of the ball or spring type set to blow off when the pressure in the retort reached a certain critical point. This was used to control the pressure rather than to ascertain whether the retort was operating at a given temperature. It operated on the principle that temperature was proportional to steam pressure, and steam pressure control would mean temperature control.

These valves are only useful for straight steam. Moreover, any air trapped in the retort will expand on being heated by the steam, and the total pressure does not give temperature control. To avoid this error, retorts were then furnished with a vent which was left open at first to blow out the air and ensure a straight steam cook. But even when operating under proper conditions, the safety valve gives no accurate indication of the temperature inside the retort. To obviate this difficulty and to render this method more flexible, the use of the pressure gauge in conjunction with the safety valve was introduced. Even though the pressure gauge is more accurate than the safety valve, its use at best gives only an estimation of the temperature in the retort and limits the retort operation to straight steam only.

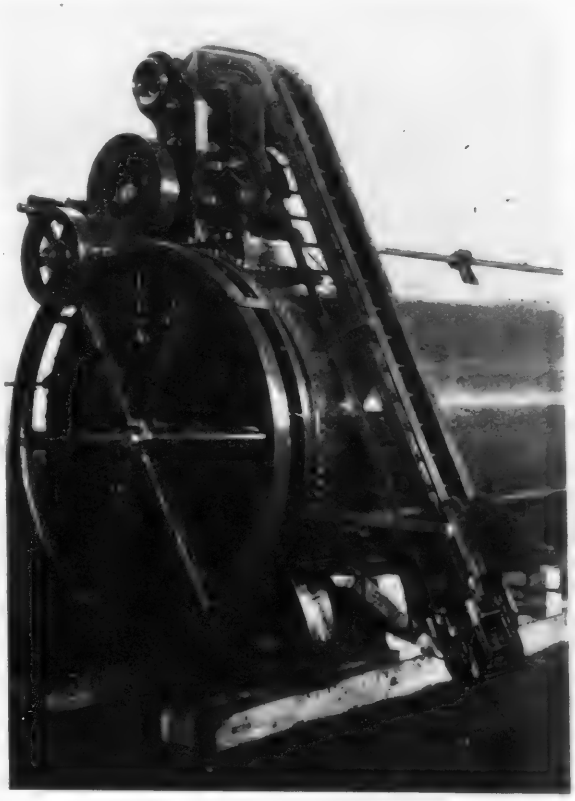


FIG. 15.—Feed End of a Continuous Agitating Pressure Cooker.

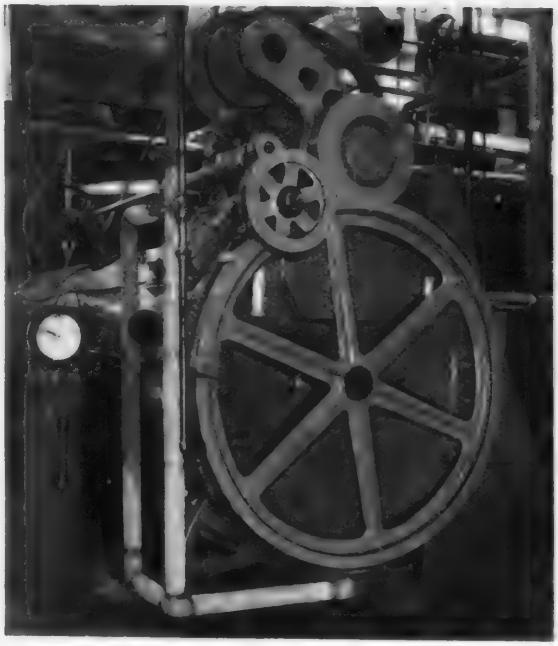


FIG. 16.—An Installation of the Continuous Agitating Retort, showing a Foxboro Temperature Recorder.

FIG. 17. Continuous Agitating Pressure Cooker, showing the Cooler.

FIG. 18.—Temperature Recorder Controller.

Even if care is added to remove all air from the retort before building up pressure, the accuracy of the pressure gauge depends at best on the atmospheric pressure at which the retort operates. Any change in this will change the reading of the pressure gauge operating at a given temperature, and this may be considerable in some cases.

The range of temperatures in common retort operation practice is from 210 to 270° F., and in this range mercury-in-glass thermometers can be used with sufficient accuracy. Since the unprotected glass thermometers are too fragile to withstand the rough usage in the cannery and are comparatively difficult to read, there has been developed what is generally known as the industrial type of mercury-in-glass thermometer. This is characterised by a heavy metal back and a protecting tube for the bulb, large distinct figures and graduation marks, temperature and pressure scale and threaded connections for attaching the instrument readily and firmly to some part of the apparatus. The space between the bulb and the outer wall of the casing is generally filled with mercury.

The retort in which this thermometer is to be installed is fitted with a thermometer pocket, generally at the side of the retort where the thermometer will be out of harm. The temperature in the thermometer pocket has been found to be several degrees lower than the retort temperature, unless this pocket is properly bled. Moreover, these thermometers have a time lag and will not reach the processing temperature as soon as the recording thermometer. In use it is necessary to vent constantly the thermometer pocket to ensure circulation of steam around the thermometer bulb, and indication of the proper temperature.

In retort operation it is not sufficient to know the temperature at which the retort operates, as the duration of time at which this temperature is kept up is important. To enable the canner to have a complete history of the processing in the retort, recording thermometers were introduced. These thermometers employ a mechanism for making a continuous record of temperature on a suitable chart. The thermometers in general use are of the vapour pressure type, which comprise a bulb containing a liquid connected by means of capillary tubing to some form of helical tube.

The temperature measuring element is a closed system consisting of a sensitive bulb, an actuating helical tube, and a capillary tubing connection between these two. This system is partly filled with liquid of definite vapour pressure for any given temperature. Heat applied to the bulb creates a vapour pressure in the system. Every change in temperature causes a proportional change in pressure which is transmitted through the capillary tube to the helical tube movement, thereby moving the pen across the chart.

The action of the vapour pressure thermometer depends upon the fact that the pressure inside the thermometer is determined solely by the temperature

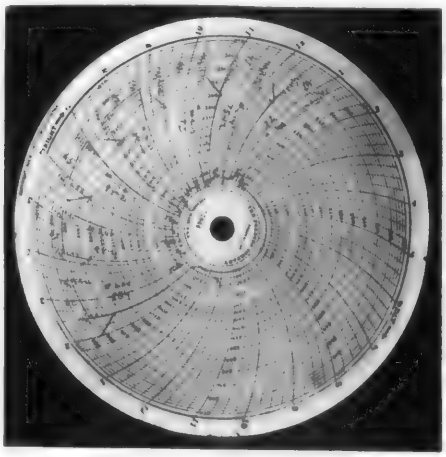


FIG. 19.—A Chart showing the Temperature during a Spinach Cook.

of a free surface of the liquid. It follows, therefore, that the thermometer must be so constructed that one free surface is always in the bulb. If this condition is fulfilled the reading of the instrument is not sensibly affected by change in temperature of the gauge and the capillary.

The introduction of automatic temperature recorder controllers in recent years suitable for cannery practice has met with great success. Practically all of the retorts in California are equipped with instruments of this type, either of the direct or reverse throttling type of control. This has led to the standardisation of a uniform process for every batch of foods so sterilised (see Figs. 5, 18, and 19).

ACKNOWLEDGMENT

The writers are indebted to Mr. E. W. Thomas and Mr. George Glendenning, of the Anderson-Barngrover Company, and to Mr. H. B. Brooks, of the Foxboro Company, for the illustrations used in the article and for aid and criticism given during its preparation.

The British Canning Industry

By SIR EDGAR R. JONES, K.B.E.

Chairman of The National Food Canning Council.

WHEN THE Welsh tinplate manufacturers began, in 1926, to initiate the creation of a canning industry in Great Britain, the situation was a very poor one. There was a small amount of fruit canning at speciality prices, and practically no canning of vegetable products. They also found that the existing facilities for the manufacture of suitable cans was very inadequate, that there was no British firm manufacturing machines for closing cans, and that there were no British firms making machinery for canning, or in a position to give advice as to the laying out or erection of canneries or technical service for the maintenance and repair of machinery.

In addition to the above serious handicaps, there was the fact that there was no institution or supply of men with a knowledge of processing, and the organisation of the trade through wholesale and retail merchants was in the hands of the importers of foreign goods.

Therefore it became necessary to stimulate growers to plant special varieties of fruits and vegetables and to adopt new methods of gathering, marketing, and contracting for the sale of the products. By means of a number of separate committees each of the above problems was dealt with, as every one of them was essential to the success of the campaign for a new industry.

Over and above all that, the prejudice of the medical profession and the public had to be overcome, and the patronage of the public secured for the purchase of the canned produce. The result of the organised effort brought about in the comparatively short time that has elapsed has, under the circumstances, been extraordinary. It is a concrete illustration of what the people of this country can do if they make up their minds to co-operate in a common effort. To-day, the production of cans is satisfactory, and American companies have taken a financial and technical interest in the new equipment and the great future prospects that they have satisfied themselves are assured.

A British engineering firm is manufacturing machinery for closing the cans, and will very soon be competing with American engineers in the production of plant for the manufacturing of cans.

It has been a disadvantage to the Welsh tinplate trade that the extension of canning throughout the world has been made with American machinery. In future, not only in the British Empire but in other countries there will be installations of British machinery working upon British tinplate.

In the past, persons proposing to erect canneries in any part of the world went to America for their technical knowledge and technical men. Already there are men from distant parts taking courses of instruction in this country, and very soon men with experience and knowledge of canning will be available for developments in other countries. The importance of this matter to the tinplate trade is considerable, because the technical adviser who goes abroad usually recommends the goods from his own country; it is because of this that American tinplates have during recent times made such headway in certain countries.

The medical and other prejudices have now been removed, and consistent support is now obtained in this connection that is constantly reflected in the public Press. The Press has been very much interested in the establishment of this new industry, and has assisted very much by the constant stream of publicity throughout the length and breadth of the country.

The commercial organisation, both wholesale and retail, is recognising the fact that the home canning industry is now a commercial success on the way to a big volume of production; the canned fruit and vegetable productions are now regularly carried in the stocks of the retail stores.

Last year there was a 100 per cent. increase in the output of canned goods over the previous year, and it is confidently expected that this year there will be another 100 per cent. increase over last year. Many new factories that are being arranged will come into operation next year, and may bring about another 100 per cent. increase. This year has provided the first good fruit crop since the campaign commenced, and there will be a very large pack of English fruits which can be sold in the shops at prices to compete with other imported fruits. At such competitive prices the public is offered a flavour and quality better than that of the imported product.

Shopkeepers and the public will be interested this year in the fact that the English fruits and vegetables will bear the National Mark of the British Government. This National Mark is awarded for a certain standard of quality, and is therefore a guarantee to the purchaser of the highest quality fruits or vegetables. If the public will look for the National Mark and ask for National Mark canned goods they will know that they are getting the best value, and that they are assisting the employment of their own relatives and friends.

During the past four years the canning industry in this country has been an industry in course of being established; this year, with the completion of the various arrangements referred to earlier, it can be said that the industry has been established. Now that its establishment has been secured, its growth will be steady and considerable.

Heat Penetration and Food Preservation

By A. SAMSON, A.R.C.S., A.I.C.
(Poulton and Noel, Ltd.).

The heat treatment of foods preserved in containers so as to effect successful sterilisation is capable of strict control, provided the basic principles involved are thoroughly appreciated and adequate attention is given to the application of these in practice. The author of this article analyses the problem in the light of his scientific training and factory experience and, in Part I, after discussing in a general way the part played by heat penetration in the process of food preservation by sterilisation and the way in which this takes place, proceeds to explain how various factors, such as the size and nature of the container and the foodstuff packed in it, influence the rate of heat penetration, and hence the time required for successful sterilisation. In Part II he gives some results of his own experiments to illustrate the various points brought out in the general discussion.

Part I.—General

A LEADING manufacturer of preserved provisions recently asked why it was that some of his goods were "blowing" after storage. Enquiry elicited the information that he was sterilising his product at 240° F., and, after further questions had been put to him, it was explained that, although the temperature was quite satisfactory, the length of time was insufficient. "Oh!" he exclaimed, "but I thought if I gave them the temperature of 240° F. they would be quite safe, because I was given to understand that all organisms were killed at that temperature."

It is to be regretted that this manufacturer did not realise the meaning of "Heat Penetration," and as a consequence his goods were understerilised.

Basic Principles.

The preservation of foods by heat treatment involves the application of a certain amount of heat, as measured by a thermometer, for a certain length of time. This application of a definite temperature for a definite time is the fundamental principle of processing or sterilising, and its idea is to destroy, or at least to render dormant, the most resistant organisms contained in the material under treatment. All bacteria can be destroyed if they are subjected for a protracted period to temperatures which will not permit them to carry on their life processes. The higher the temperature the shorter the time required to destroy them, and *vice versa*. All bacteria can be destroyed in a few minutes at 250° F. If a temperature of 212° F. were adopted, the destruction of the bacteria would take approximately one hundred times longer. Hence it is clear that foods can be preserved either at a high temperature for a short time, or at a much lower temperature for a much longer time. The times and temperatures of preservation adopted are matters for long and serious study and are dependent, amongst other things, on the material to be preserved. One has to take into consideration the foodstuff to be preserved, its composition, and the most resistant bacteria generally associated with such foodstuff. But besides these factors there is another, whose degree of importance depends on the material and the container, and that is, the ability to allow the heat to penetrate to every particle of foodstuff in the container.

Meaning of Heat Penetration.

It is always assumed that the coldest portion of the material packed in a can or glass is at the centre, and during processing heat travels from the outside of the container to the centre. This ability to allow heat to flow to the centre is known as the heat penetration of the material, and the rate of flow, which can be measured, is dependent on several very important considerations.

I propose, in this article, to discuss the principle of heat penetration and its bearing on the operation of processing.

Much work on heat penetration has been done in America, principally by Bigelow of the National Canners' Association and his collaborators. These men have made an exhaustive study of the foods as processed in America, and have worked out processes for all classes of material. Much credit is due to the Americans for our knowledge of heat penetration.

Heat Transference.

In the first place it is necessary to understand how heat is transferred through materials. Heat transference takes place in two important ways—namely (1) Conduction and (2) Convection. Conduction takes place by the transference of heat from molecule to molecule of the substance, and is generally associated with solid or pasty substances. Thus the transference of heat in the case of an iron rod is by conduction, as the heat is conducted from molecule to molecule.

Convection is the transference of heat by the actual movement or streaming of the material being heated ("convection currents"), and is generally associated with liquids or gases. When a liquid is heated, that portion which is warmer becomes less dense and, consequently, tends to rise, thereby creating currents by means of which the heat is distributed throughout its mass.

Rate of Transference.

Not all materials have the same rate of transference of heat. There are good and bad conductors of heat, such as copper and wood respectively. Likewise, liquids have different rates of heat transference; thus, for example, water is heated more quickly than a gelatine solution. In the case of preserved foodstuffs, heat transference takes place by both conduction and convection, depending on the material and its state. One fact must be particularly remembered; it takes longer for a substance to be heated by conduction than by convection. In other words, materials are more quickly heated when liquid is present—thus allowing currents—than when solid or pasty, when currents are prevented and heat distribution can take place only by conduction.

Thus, a tin of fruit or peas would be heated more quickly, on account of the liquid present, than would be the case with the same tin filled with tongue or galantine or paste. In the former case the contents are heated by convection currents in the liquor, whereas in the latter we have to rely on conduction.

As explained previously, the centre of the can or glass of foodstuff is always assumed to be at the lowest temperature. Hence in all work on heat penetration we always determine the rate by measuring the temperature at the centre of the container.

Thermometers.

It has often been suggested that this temperature can be measured by the "tell-tale" or clinical thermometer. Without entering into a discussion of the serious disadvantages attendant on the use of such thermometers, I strongly deprecate this suggestion, as their use leads to erroneous and confusing results. No heat penetration tests can be relied on when using clinical thermometers.

A much better instrument, giving more reliable results, is the ordinary chemical thermometer, and I have obtained, under certain conditions, some excellent results using such a thermometer with a very small bulb and a range of 70 to 260° F.

However, the best instrument to use in order to obtain accurate readings is the thermocouple. This type of thermometer has been highly developed by Bigelow, of the National Canners' Association. Very briefly, it consists of two wires of different material, generally one of copper and the other of constantan. They are joined at their extremities. If the two junctions are now held at different temperatures—one end in ice and the other in hot water—an electric current will be generated in the wire proportional to the differences in temperature between the two junctions. This current can be measured by means of a potentiometer which can be calibrated in degrees Fahrenheit. Although crude in outline, this explanation will serve to show the principles involved in the functioning of the thermocouple. It is the best type of instrument to use for measuring heat penetration.

Time-Temperature Curves.

Heat penetration experiments are conducted by measuring the temperature at the centre of a can or glass of foodstuff at successive intervals of time. Having obtained these readings, they are plotted on graph paper, the vertical line showing degrees of temperature, and the horizontal line showing time in minutes. Having placed all the points of observation on the graph paper, these points are joined into a curve. This curve is known as the "heat penetration curve" and by it one is enabled to determine the temperature at the centre of the can at any particular time during the period of processing, and, therefore, the rate at which heat is being transmitted through the material under treatment. It will now be possible, having some idea of the types of resistant organisms associated with a foodstuff, to fix a definite length of process for that foodstuff.

In examining any heat penetration curve three distinct portions will be observed. The first, or rapidly rising portion, corresponds to the time during which the retort temperature is rising. The second, or flatter portion, corresponds to that time during which the retort is maintained at the steady position. The third, or final portion, corresponds to the cooling of the retort when the process has been completed. It will be noticed that the rates of change of temperature at the centre of the can or glass are not as rapid and marked as the changes of temperature in the retort. Thus the temperature first rises very slowly at the centre. This is due to the fact that when heat is first applied the material between the centre and outside of the can absorbs this heat and then gradually passes it on to the centre. Furthermore, after the retort has been "steadied," heat still passes to the centre. During the third portion, although the process is finished—the steam cut off and the retort cooling—the centre of the can may still be rising in temperature for some little time, due to the fact that the temperature of the foodstuff at the centre of the can is not so high as that at the outer parts. Consequently, heat passes from this portion to the centre, thereby raising its temperature. At the same time, heat passes to the exterior of the can and is lost, thereby cooling the can. Eventually there results a state of equilibrium, and heat will pass after preserving from the centre of the can, which is hottest, to the coldest or outside portion of the can.

Influence of Materials.

In discussing the heat penetration of various materials there are many factors which have an important effect on the rate of heat transference.

Containers for the preservation of foodstuffs consist principally of glass and tinplate. Tinplate is a better conductor of heat than glass, experiments showing that the former conducts heat about thirty times more rapidly than glass. Water is a bad conductor of heat, being about one-quarter as rapid as glass in the transference of heat by conduction. This explains the slow heat penetration of many foodstuffs containing a large amount of water, because, not being free to circulate, the water is heated by conduction and not by convection. Such is the case with pumpkin, potatoes, sliced apples. If, however, the water is able to circulate more or less freely, as in the case of peas in brine or fruits in syrup, heat transference takes place by convection currents, and we get heat penetration taking place as rapidly as

it is conducted through glass. Hence, this fact raises one very important point. In preserving foodstuffs, either in glass or in tin, the effect on the rate of heat penetration of the composition of the container depends on the material in the container. If the material to be preserved is heated only by conduction the rate will be slow; therefore the composition of the container will have no effect on the rate. If, on the other hand, the material is heated by convection currents, the rate will be rapid, and, in consequence, a glass container will take longer to transmit the heat than a tinplate container. Thus, in preserving potted meat in either a glass or tin container of the same shape and capacity, the potted meat is heated by conduction, and, consequently, the rate of heat penetration will be approximately the same in both containers. If peas or beans are preserved in brine, employing the same capacity containers, one of glass and the other of tin, the heat penetrates by means of convection currents, and, in consequence, the rate will be much slower in the glass container than in the can—often taking twice as long in the former, depending on the contents.

Influence of Size of Container.

It is well known that larger cans are heated during preservation for a longer time than smaller cans. This is due to several reasons—viz. (1) To the greater amount of material to be preserved; (2) the greater distance between the exterior and the centre of the can; (3) the ratio of surface area to quantity of material is smaller in the larger can. In many cases it is possible to calculate the time to be given to larger cans. This applies to circular cans whose lengths are greater than their diameters. Furthermore, it applies only to those cans the contents of which transmit heat slowly—that is, by conduction. Such foods are galantines, solid-packed meats as tongue or brisket, potted meat and fish pastes, solid-pack apples, spinach, tomato pulp, baked beans, fish, etc.

It has been found, by experiment, that the time necessary to heat the centres of cans of different sizes to a certain temperature is approximately proportional to the squares of their diameters. Supposing it requires 40 minutes to bring the centre of a No. 1 can of a certain kind of foodstuff to 230° F., and the time is required to bring the centre of a No. $2\frac{1}{2}$ can to the same temperature:

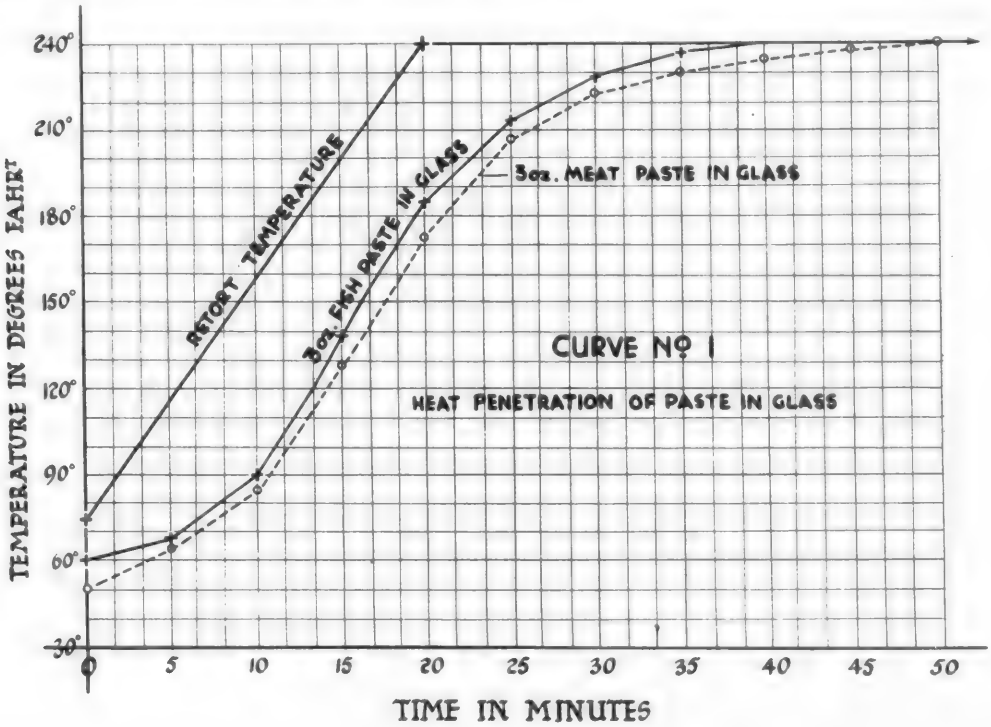
Diam. No. 1 can $= 2\frac{11}{16}'' = 2{\cdot}7''$ (approx.) $D^2 = 7{\cdot}3$
Diam. No. $2\frac{1}{2}$ can $= 4\frac{1}{16}'' = 4{\cdot}06''$,, $D^2 = 16{\cdot}5$

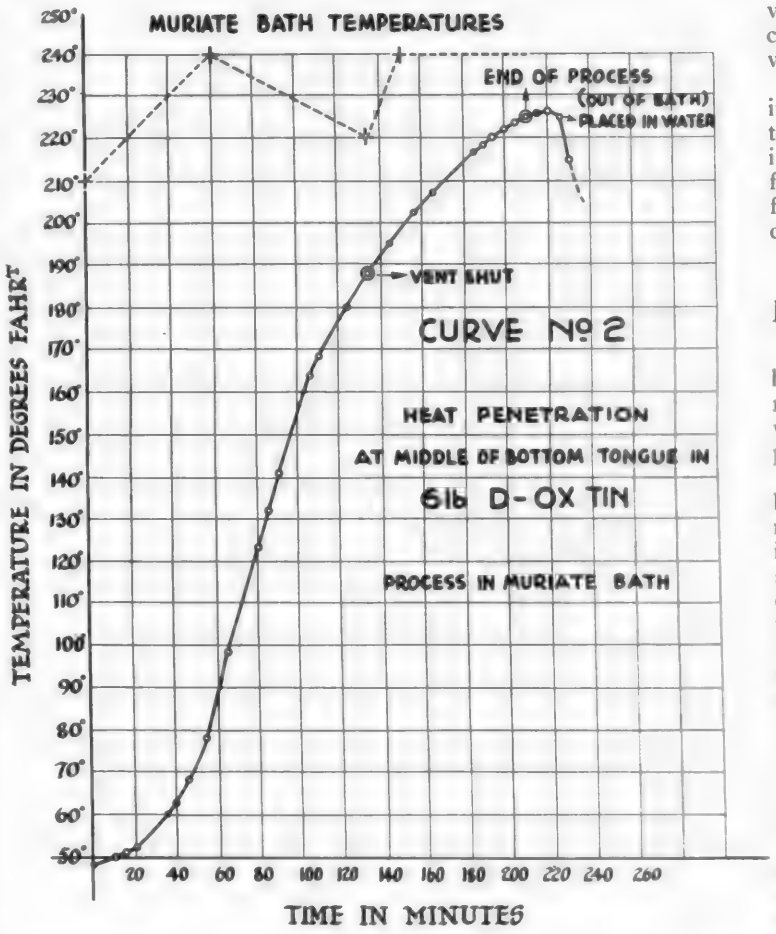
Therefore, time to heat No. $2\frac{1}{2}$ can equals:

$$\frac{16{\cdot}5}{7{\cdot}3} \times 40 = 90 \text{ minutes approx.}$$

Influence of Composition of Liquor.

The composition of any liquor present in the container has an effect on the heat penetration. It has been found that dilute solutions of salt or sugar do not interfere appreciably with the rate of heat penetration. However, strong sugar solutions or syrups do retard the rate, probably owing to the increase in viscosity of the solutions. On the other hand, it has been shown that dilute solutions of gelatine and starch greatly interfere with heat penetration. Thus, in the case of gelatine solutions, heat penetration is slow even when much liquor is present, as in brawns in glass or tin, chicken and chicken breasts in jelly. In the case of starch we have a similar retarding effect.




MURIATE BATH TEMPERATURES
END OF PROCESS
(OUT OF BATH)
PLACED IN WATER
VENT SHUT
CURVE Nº 2
HEAT PENETRATION
AT MIDDLE OF BOTTOM TONGUE IN
6lb D-OX TIN
PROCESS IN MURIATE BATH
TEMPERATURE IN DEGREES FAHRT
TIME IN MINUTES
250° 240° 230° 220° 210° 200° 190° 180° 170° 160° 150° 140° 130° 120° 110° 100° 90° 80° 70° 60° 50°
20 40 60 80 100 120 140 160 180 200 220 240 260

The heating of fresh peas in tins is rapid, the brine assisting heat penetration by convection currents; but in the case of the canning of dried or soaked peas, soon after processing has commenced, some of the starch is dissolved out of the peas, and the liquor —originally a weak brine—becomes a dilute solution of starch. Consequently, heat penetration is not as rapid in these peas as in fresh peas. The same remarks apply to new potatoes, especially if they have been slightly abraded in the process of cleaning.

Influence of Material Size and Nature of Packing.

One also obtains variation in heat penetration according to size of the pieces of material being packed. Thus a whole ox-tongue preserved with jelly in a glass, and ox-tongue sliced or diced, as in the case of brawn, will exhibit such variations. In the case of the whole tongue the convection currents in the jelly are impeded by the tongue, whereas the smaller pieces of sliced or diced meat do not interfere to the same extent. So also in the case of fruits and vegetables—the rates of heat penetration in a tin or glass of the material lightly packed and filled with liquor are not the same as those resulting when the container is heavily packed with the fruit or vegetable. The reason is that the more closely packed article impedes the convection currents set up in the liquor.

A certain quantity of overripe fruit in a can may have a lower heat penetration value than if that same fruit were in a firmer condition, because overripe fruit on heating tends to soften and form a compact mass which impedes convection currents.

Part II.—Experimental Results

With these general statements, it will be of interest to consider some of the results of my experiments conducted with the object of evaluating heat penetration curves.

In the first place, it must be remembered that preserving foodstuffs in a muriate bath, as in the case of meats, is quite different from preserving the same foods in a retort. In the former case only about two-thirds of the container is immersed in the muriate, whilst the remaining one-third is exposed to the cooling influence of the surrounding atmosphere. In the case of the retort the whole of the container is exposed to the heating medium; consequently the rate of heat penetration in using a retort is slightly higher than when a muriate bath is employed.

Again, I have found that, according to the practice prevailing in this country of preserving meats either in tin or in glass, the retort or muriate-bath temperature is seldom, if ever, reached by the material at the centre of the container. The highest temperature is generally 5 to 15° F. below the retort temperature, depending on what is being preserved. This is more so in the case of the larger tins, such as 6-lb. or 12-lb. tins of tongue or brisket.

Furthermore, I have found that where the muriate bath is used there is a difference in temperature, in the same container, between the upper half and the lower half. For example, in the case of ox-tongues in 6-lb. tins, I have found that the lower tongue has reached temperatures 2 to 3° F. higher than the upper tongue. This is because the lower tongue is completely submerged in the heating medium, whereas the upper tongue is only partly submerged. As examples of heat penetration curves, the following will explain the results of two experiments concerned with meat products. Curve No. 1 shows the heat penetration curve of 3-oz. glass jars of fish paste and of meat paste. A retort temperature of 240° F. was reached in 20 minutes. It will be seen that it takes 40 minutes for the jar of fish paste to reach retort temperature, and 50 minutes in the case of the meat paste.

Curve No. 2 shows the heat penetration of a 6-lb. tin of ox-tongue in the **D**-shape. The muriate-bath

(Continued on page 302.)

The Canners' Exhibition at Leicester

Demonstration of Fruit Canning Line: All-British Manufacture

ONE OF the chief attractions at the Canners' and Allied Trades' Exhibition at Leicester (October 24 to November 1, 1930) will be the demonstration canning plant of British manufacture exhibited by Messrs. F. J. Ballard and Co., Ltd. (Tipton), and Messrs. Mather and Platt, Ltd. (Manchester), in collaboration with Messrs. J. Rhodes and Sons, Ltd. (Wakefield). Working demonstrations have been arranged to take place each day at 12.30, 3, 6, 7, and 8 p.m., and there will be a special one on Thursday, October 30, at 10.15 a.m. No fruit will actually be canned, but the plant will be operated on empty cans.

The following machines are incorporated in the fruit canning line for A. 2 lb. size cans:

Automatic Syrup Machine (Mather and Platt, Ltd.).

Water Exhauster.

Semi-Automatic and Full Automatic Can Closing Machines (J. Rhodes and Sons, Ltd.).

Automatic Variable Discharge Cooker.

Automatic Cooker and Ejector.

The Operations Described.

The following is an account of the various operations involved in the canning line:

Operation 1.—The cans are fed by means of a conveyor belt into the automatic syrupper, where they are filled with syrup.

Operation 2.—The cans are automatically transferred from the syrup machine to the water exhauster. The object of the exhauster is to remove as much as possible of the air out of the can, which if allowed to remain would cause undue strain on the can in the final process. The exhauster is designed to give a long exhaust with uniform temperature; this is essential to secure the correct heat penetration. The exhaust is of the well-known three double run disc type used extensively in the canning trade

The advantages of this type over others are as follows:

(*a*) The largest capacity in a given floor space.

(*b*) No tendency to spill the contents of the cans.

(*c*) Each line of discs is driven individually from the centre of the machine.

(*d*) All parts are easily accessible.

The cans are automatically discharged from the exhauster on to a stacking table in readiness for the next operation.

Operation 3.—The cans are fed by hand into the closing machine for sealing. The lids are rolled on the cans, making them absolutely airtight.

Note. When a fully automatic closing machine is used, the cans are delivered automatically from the exhauster to the closing machine; therefore, a stacking table would not be required.

Operation 4.—The cans pass automatically from the closing machine to the variable discharge cooker.

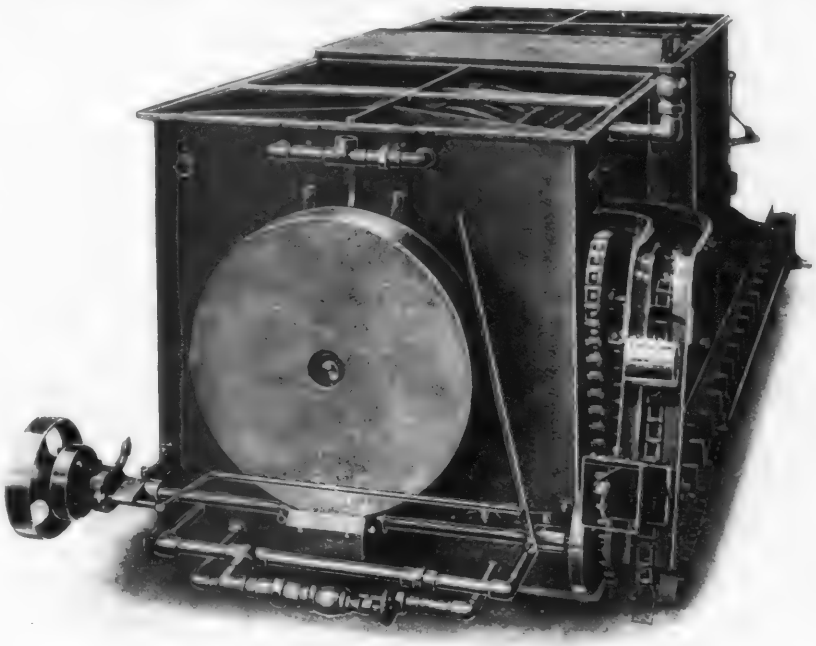
The can-carrying unit in the cooker is of the reel and spiral type, the outer member being formed into a spiral path and held stationary by substantial angles, which in turn are secured to the tank; while the inner member of the reel is made to revolve slowly and advance the cans to the spiral path, each can in a separate pocket, and all cans travelling their length with each revolution of the can-carrying reel. In this type of cooker the cook is determined not by regulation of speed at which the machine is driven, which always remains the same, but by the door at which the cans are allowed to discharge, thus ensuring a remarkable uniformity of heat penetration and also of the time at which the contents of the cans reach an effective cooking temperature. By this method it has also been found that most products can be safely processed in much less time than is possible with the batch method, and, consequently, a much better product can be made.

Operation 5.—When cans are ejected at whichever door is being used, they are carried along the conveyor and elevated into the top of the

cooler. The can-carrying unit in the cooler is similar to the cooker and is just as efficient. Cold water is sprayed on the cans as they revolve, and when cool they are mechanically ejected on to a chute, which will carry them to the stacking section.

Apple Canning Line.

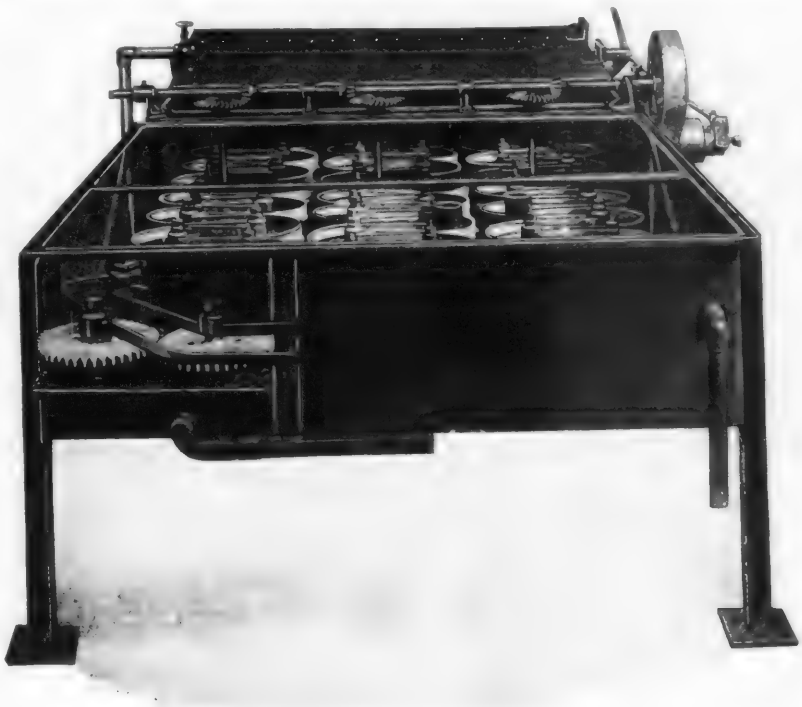
In addition to supplying the automatic syrup machine for the above exhibit, Messrs. Mather and Platt, Ltd., are also showing *a complete line of machinery for the canning of apples*. This embodies several new features and will be the subject of very great interest amongst those concerned with the development of the British canning industry.



The Automatic Variable Discharge Cooker.

Can Making Machinery.

The various exhibits of Messrs. Joseph Rhodes and Sons, Ltd., foreshadow the immense developments and extensions which this firm is carrying out in order to meet the demands for automatic can making machinery of the latest type. One machine exhibited by this firm is the *Automatic "Stagger" Press*, which offers important advantages over the strip feed press, in that it is unnecessary to cut the sheet into strips; the whole sheet is used, untrimmed at the edges. Further, the stampings can be staggered, thereby effecting an economy of upwards of 10 per cent. in tinplate. An *Automatic Curling Device* may be attached to this press. We understand that users are getting as many as 400 gross stampings per press per day.



Disc Type Water Exhauster.

Amongst other machines exhibited by Messrs. J. Rhodes and Sons, Ltd., we may mention the patent *"Simplex" Drawing Device*. The inclinable press fitted with this device will be shown stamping a seamless paste tin at one operation. Also, the *Full Automatic Double Seaming Machine* will be represented at the Exhibition.

Processing Times and Temperatures

We have received from K. F. MEYER, of the George Williams Hooper Foundation for Medical Research, University of California, a copy of Bulletin No. 26-L (National Canners' Association Research Laboratory, January, 1930), entitled Processes for Non-Acid Canned Foods.

In this bulletin are presented the sterilising processes for non-acid foods adopted by the Board of Directors of the National Canners' Association at their meeting in Chicago on January 18, 1930, to be effective until April 1, 1931, by which date it is expected that the list of processes will be extended by the inclusion of data resulting from experimental work now in progress.

Prefacing the list of processes are approved recommendations with respect to equipment and its operation, as well as definitions of the terms used in the processing tables. This information is essential to the correct interpretation and proper use of the processes given in the bulletin.

The following information has been extracted.

Process Temperatures.

The processing in boiling water at 212° F. of any product listed in the table is impracticable. For sterilisation equivalent to that represented for most of the products, continuous boiling for over ten hours would be required. No process temperature under 240° F. is shown in the table. If an individual canner feels that he must use a lower temperature, this will be treated as a special case and the time equivalent to that required at 240° may be given on request.

High Temperature Processes.

For a product having rapid heat penetration, very short processes at comparatively high temperatures are sometimes used; for example, the process of 12 minutes at 248° F. for white asparagus. It is especially important that such processes have the most careful control, and if a still retort is used, it should be handled with the utmost care. An error in either time or temperature in a short high temperature process will have a much greater effect upon the total sterilising value of the process than a like error will have in a longer process at a lower temperature. Cooks of less than 10 minutes should not be employed in discontinuous retorts unless mechanical control is provided which will give results comparable with those obtained in continuous cookers.

Initial Temperature and Closing Temperature.

The term "initial temperature" is used herein to designate the temperature at the centre of the can at the time steam is turned on for the process. Under this definition the temperature at which the can is closed will not be the initial temperature unless the process begins very soon after the can is closed. If a can is closed at a temperature higher than that of the canning room and is then held for some time in the atmosphere of the room before it is processed, the initial temperature will be lower than the closing temperature. It is the initial temperature, and not the closing temperature, of the can which, in some cases, is an important factor from the standpoint of sterilisation.

All cans should be closed and processed under such conditions that in commercial shipment the ends will retain a concave position under all conditions of temperature and altitude. Commercial experience has indicated that with products packed in brine without mechanical vacuum, the average temperature of the contents of each can at the time of closure should be at least 130° F., to ensure a satisfactory vacuum. "Average temperature" is that temperature which may be obtained at the time of closure after mixing the contents of the can.

Type of Retort.

The processes contained in the tables are for both still and agitating cookers unless a research laboratory connected with the canning industry advises other times or temperatures for agitating cookers.

Retort Equipment.

For proper operation each retort should have the items of equipment named below:

1. An automatic controller to accurately maintain the temperature at the specified point.
2. An indicating mercury thermometer.
3. A recording thermometer.
4. A pressure gauge (preferably compound type).
5. A vent of at least ¾-inch inside diameter in the top.
6. A ⅛-inch bleeder in each thermometer well or pocket.
7. At least one ⅛-inch bleeder in the top of the retort.
8. A steam by-pass around the controller to make possible a rapid rise to processing temperature.
9. A perforated steam line entering the retort at the bottom beneath a perforated steel baffle plate.

Description of Instruments.

The temperature range of each thermometer (items 2 and 3 above) should be 170° to 270°, and the scale divisions should be of either one degree or two degrees each—never greater than two degrees. The scale of the indicating thermometer should be at least 7 inches in length and the thermometer should have a pressure scale corresponding to the temperature scale. If the recording thermometer is of the circular type, the chart should be at least 10 inches in diameter.

The pressure gauge should have a range of 0 to 30 pounds and the seals should be graduated in 1-pound divisions. The gauge will preferably have a 5-inch dial.

Explanation of Can Dimension Code.

In the process tables on the following pages, the can sizes are given in the code usually employed in the industry. Each dimension is expressed in a number of three digits. The left-hand digit gives the number of whole inches, and the two right-hand digits give the additional fraction of the dimension expressed in sixteenths of an inch. The first number of the series given in the size of each can is the diameter of the can. For instance, the dimensions of the No. 1 can are given as 211×400, which means that the can is 2 11/16 inches in diameter and 4 inches high. The No. 2 can, designated in the code as 307×409, is 3 7/16 inches in diameter and 4 9/16 inches high.

The dimensions are "over all," the diameter being measured to the outside of the double seam and the length including the entire seam at each end of the can.

Below is given an abstract from the tables.

Can Name.		Dimensions.	Initial Temperature.	Retort Temperature.	Time.
			° F.	° F.	Min.
Beans, string ...	No. 1	211×400	—	240	20
	No. 2	307×400	—	240	20
	No. 2½	401×411	—	240	25
	No. 3	404×414	—	240	25
	No. 5	502×510	—	240	35
	No. 10	603×700	—	240	40
	No. 2 Glass	—	—	240	30
	10-oz Glass	—	—	240	30
Beets, whole, cut, or diced ...	No. 1	211×400	140	240	25
	No. 2	307×400	140	240	25
	No. 2½	401×411	140	240	25
	No. 3	404×414	140	240	25

Can Name.		Dimensions.	Initial Temperature. ° F.	Retort Temperature. ° F.	Time. Min.
Carrots, whole sliced, or diced*	No. 1	211 × 400	140	240	25
	No. 2	307 × 409	140	240	25
	No. 2½	401 × 411	140	240	25
	No. 3	404 × 414	140	240	25
	No. 5	502 × 510	140	240	40
	No. 10	603 × 700	140	240	45
Cauliflower† ...	No. 1	211 × 400	—	240	20
	No. 2	307 × 409	—	240	20
	No. 2½	401 × 411	—	240	20
	No. 3	404 × 414	—	240	20
Celery hearts ...	No. 1	211 × 400	—	240	20
	No. 2	307 × 409	—	240	20
	No. 2½	401 × 411	—	240	20
	Quart Olive	307 × 704	—	240	20
	No. 2½ Square	300 × 308 × 604	—	240	20
Mushrooms‡ ...	No. 1	211 × 400	—	240	20
	No. 2	307 × 409	—	240	20
	No. 2½	401 × 411	—	240	20
	No. 3	404 × 414	—	240	20
	No. 10	603 × 700	—	240	35
Peas—I. ...	No. 1	211 × 400	—	240	40
			—	245	30
			—	250	20
	No. 2	307 × 409	—	240	40
			—	245	30
			—	250	20
	No. 5	502 × 510	—	240	50
			—	245	40
			—	250	25
	No. 10	603 × 700	—	240	60
			—	245	45
			—	250	30
Peas—II.§ ...	No. 1	211 × 400	—	240	27
			—	245	17
			—	250	12
	No. 2	307 × 409	—	240	27
			—	245	17
			—	250	12
	No. 5	502 × 510	—	240	33
			—	245	23
			—	250	18
	No. 10	603 × 700	—	240	38
			—	245	28
			—	250	22

* If carrots are lye-peeled, the cooks apply only provided the lye has been completely removed by washing.

† These are the minimum processes that can be used with safety. They may produce an unsatisfactory product, but the process should not be reduced.

‡ The processes for mushrooms are based on commercial experience and analogy with products having a similar rate of heat penetration.

§ These processes for peas may result in spoilage and are not recommended. They are the minimum cooks necessary to safeguard the health of the consumer.

National Mark Canned Fruit, Peas, and Beans.

THERE should be a strong demand for National Mark canned fruits and vegetables by the end of the year—that is, if favourable Press comment and advertising count for anything.

Since the scheme was launched at the beginning of June, frequent references to it have been made in the Press. In a description of the Royal Welsh Show, for instance, Sir W. Beach Thomas, the agricultural correspondent of one of our leading national dailies, wrote the following under the heading "Canned Fruit Eye-Opener":

"There was a display of the latest addition to British goods sold under the National Mark.

"They were tinned fruits.

"And they may have earned an historic advance in the appreciation of British produce.

"Let every householder everywhere order these. The fruit must pass the test before it is granted the Mark, and, after testing the product, I would go bail for its excellence.

"Never again need British fruit-growers fear a surplus if these tinned fruits earn the reputation they deserve.

"They are as good as fresh strawberries, raspberries, or logans, to quote the three I personally sampled."

And in the same paper a few days later, reviewing a book on fruit-growing, Sir W. Beach Thomas wrote:

"Great things are expected from the new and rapid increase of the canner of British fruits under the National Mark. This produce is as good as fresh fruit. Only the freshest and best fruit can be canned, and, therefore, foreign supplies are ruled out.

"Both the shops and the public are beginning to demand British fruit in this form, and as many as thirty odd canneries are now in active operation. Its quality ought to be appreciated by all domestic caterers. This business should automatically cure the evil of excessive British supplies."

National Mark canned fruits and canned peas will be prominently featured in an advertising campaign which is now being arranged by the Ministry of Agriculture. A series of advertisements, telling the public what the National Mark is and what it represents, is to appear in the national Press in the autumn and early winter. Arrangements have also been made for National Mark canned fruits and canned peas to be advertised separately, by means of side streamers on London omnibuses, for a period of fifteen weeks, commencing mid-September. At the same time other National Mark products will be advertised in a similar manner.

The Ministry provides, free of charge, liberal supplies of display material which, together with tins of National Mark fruit and peas, can be used to make attractive shop window displays.

Supplies of the produce itself, canned fruit in particular, will be plentiful. Eleven of the largest fruit canning firms in the country have now been registered as canners under the scheme. Several million National Mark labels for canned fruits and peas have been issued, while some firms have availed themselves of the alternative method of applying the National Mark design by incorporating it in their own private brand labels.

Retailers who stock National Mark canned English fruits should find a ready sale to a public which is becoming increasingly appreciative of canned home-grown fruits as a welcome change from imported tropical or semi-tropical fruits. English fruits packed under the scheme embrace carefully chosen varieties of dessert plums, apples, strawberries, loganberries, raspberries, blackcurrants, and gooseberries. National Mark canned vegetables provided for under the scheme are peas and beans.

Another important point that retailers should not overlook is that they will be able to show their customers the National Mark on the tins as clear evidence that the contents are home-produced.

National Mark canned fruit is the only home-canned fruit which carries with it a statutory guarantee of origin, and whose quality is safeguarded by the provision of official inspection of produce before and in process of being canned, and of official sampling of canned fruit when ready or offered for sale to see that it complies with the high standard of quality required under the scheme. National Mark canned fruit is available in large quantities, it will undoubtedly be asked for by customers as the result of national advertising, and retailers should weigh the above consideration carefully when invited to stock other canned fruit of uncertain origin and quality not bearing the National Mark.

National Mark produce will mean satisfied customers, and, as all shopkeepers are aware, satisfaction is the essence of good business.

MINISTRY OF AGRICULTURE AND FISHERIES,
10, WHITEHALL PLACE,
LONDON, S.W. 1.
September 16, 1930.

Preserving Fruits in Small Containers by Freezing

THE INVESTIGATIONS in packing by freezing, conducted during 1929 by the United States Department of Agriculture, dealt almost exclusively with questions arising from the use of small containers in this method of preserving fruits and vegetables. About 2,000 experimental lots were dealt with in this way.

Reporting on the results of these investigations, Mr. H. C. Diehl, of the United States Department of Agriculture, says that, in order to appreciate properly the character of the cooling and freezing problems, it is necessary to remember that refrigeration must do three things for frozen pack fruit: (1) It must reduce the so-called field heat; (2) it must deal with the heat of fruit respiration, which is an appreciable factor at higher temperatures; and (3) it must dissipate the heat of fusion which occurs as a result of ice formation and which amounts to 144 British Thermal Units for every pound of water that is frozen.

As a general commercial practice at the present time, freezing at 0° to 10° F. room temperature is probably most desirable. Further experiments are necessary to determine whether cooling and freezing can better be accomplished by immersing the containers in cold brine or in some other refrigerant.

Equally important with appearance may be mentioned texture, flavour, and aroma. Texture is largely dependent on two factors: maturity and sugar concentration of the liquid surrounding the fruit. The experiments have shown that texture in fruits is affected favourably by the use of syrup in suitable concentration. Sugar pack fruit has invariably been more limp, and sometimes leathery in texture and shrivelled. Packs prepared with syrups having a low Brix reading, with water or with fruit juice alone, or those packed with no sweetening, generally have had a soft, mushy, undesirable texture. For berries, a 70° syrup gave the best texture, and 50° syrup appeared to be a minimum. Although 70° syrup was the maximum concentration used, this does not preclude the possibility that syrups of higher Brix readings might also be very desirable. These more concentrated syrups must be warmed in order that they may flow freely under commercial conditions. Of the sugar packs, a 3+1 to 5+1 pack seemed most suitable, but not so good as the syrup pack.

For cherries, firmness of texture increased markedly with sugar concentration. The sugar pack sour cherries, for instance, in 3+1 or 1+1 packs showed this to be true to an undesirable degree, and the cherries were too tough in texture and showed shrivelling. The ideal pack was found to be a 30° to 40° syrup, with 6+1 or 7+1 sugar packs close seconds, and with particular flavour being given the syrup packs because of relative freedom from toughness. Cherries that have been bruised in packing seem to have a softer texture, particularly in sugar packs and in those put up unsweetened. Unpitted cherries always seem to show some splits after freezing, regardless of the pack.

For apricots and peaches a 40° to 55° syrup gave best results. The texture of syrup packs always seemed softer than that of canned fruit, but was firmer and more desirable than that of sugar pack or unsweetened apricots and peaches. Where carbon dioxide gas had been used to replace the air in the container, the texture of peaches was softer and the fruit tissue showed signs of disintegration.

Frozen pear texture was very unsatisfactory. Frozen cantaloupes had a leathery texture which was inferior to that of fresh fruit. Peeled rhubarb had the best texture when covered with a 60° or 70° syrup, and the same was markedly true for gooseberries.

From the standpoint of agreeable flavour, the more concentrated syrup packs were generally favoured. For fruits the Brix readings of the liquid surrounding the fruit after freezing and thawing generally fell within the range of 30° to 35° for most agreeable sweetness and best flavour, although occasionally they occurred in the 25° to 30° range. With more acid fruits, the most agreeably tasting lots of ten had Brix readings in the range of 35° to 40°.

In the sugar packs, there was generally more variation in sweetness and agreeable flavour in any lot due to lack of uniformity in the sugar mix and solution. The fruit which was not wetted by the syrup, and as a result had oxidised, invariably had an inferior flavour.

With raspberries and loganberries, a 60° or 70° syrup gave the most agreeable flavour, and the minimum appeared to be a 50° Brix syrup. A 3+1 sugar pack was often too sweet, a 5+1 was generally agreeably sweet, and a 7+1 not sweet enough. Blackberries were an agreeably sweetened pack when prepared with a 40° to 50° syrup.

When syrups at temperatures of 58°, 75°, 100°, 125°, 150°, 175°, and 200° F. were added to strawberries, the product appeared to be slightly lighter in colour when the hotter syrups were used.

For apricots and peaches, a 50° to 60° syrup pack seemed generally to be the most desirable of all, while the 5+1 pack seemed to be the most satisfactory of the sugar packs.

Where oxidation had occurred in apricots or peaches, there was a strong bitter after-taste of apparently glucosidic origin, which was masked, however, by the added syrup or sugar.

For sour cherries, a 70° syrup pack was most agreeable in flavour, with 3+1 or 5+1 sugar packs next in flavour. All sour cherry packs had a bitter astringent after-taste, apparently linked with immaturity of some of the fruit.

For sweet cherries, syrups in the Brix range 30° to 50° were most pleasantly flavoured, while 7+1 or 6+1 sugar packs were also quite agreeable. Unpitted cherries had a flavour suggestive of benzaldehyde, which, however, was disagreeable.

The flavour of gooseberries was most agreeable when they were packed in 60° to 70° syrup, while cantaloupe was liked best when put up with a weak salt brine.

Glucose.

Glucose sugar used alone was of no value as a sweetening agent. Glucose syrup, however, gave a rather satisfactory product with strawberries, as did invert syrup, which was used in an effort to obtain greater sweetness with a lesser amount of sweetening agent than when cane sugar was used. Honey, when added to strawberries, gave an attractive and pleasantly flavoured product, and suggested a possible frozen fruit pack for those to whom the use of cane sugar is forbidden.

Fermentation.

Much attention has been given by investigators and by the frozen pack industry to the prevention of surface moulds, fermentation, and decomposition. In so far as the latter two problems are concerned the solution is easily stated. The experiments have repeatedly shown that when clean, fully ripe, but firm fruit is used, when the packing is done in a clean way, and when cooling and freezing are reasonably rapid and the fruit is kept frozen—services which can be obtained in responsible, well-managed cold storage—there is little need for apprehension regarding fermentation and decomposition up to the time the consumer obtains the frozen fruit.

Moulds.

The problem of surface moulds on frozen pack fruit is often not readily solved because of the widespread distribution of the fungus spores. Moulds will develop, even on first-class fruit, if the spores are given an opportunity to germinate, and they will grow slowly in cold storage temperatures. However, the shielding of the fruit surface with syrup of suitable concentration during the cooling and thawing periods seems quite effectively to inhibit their development.

Containers.

The question of container choice for frozen pack is indirectly related to the basic problems of frozen pack physiology. While observations were made during the season on different types of containers, some of these are of more particular interest to the

manufacturer. A tightly sealed container, which is made unfit for re-use upon opening, should be an essential characteristic, regardless of the material of its construction. Certain advantages are claimed for each type by its proponents, while certain disadvantages may also exist. The evaluation of these and the decision as to what container type to use can better be made by the prospective packer himself if he has the basic facts developed.

In the experiments there seemed to be a very definite place for each of the types used—the tub-shaped paper container, the pound flat tin can, and the small glass container, the two last being capable of vacuumisation. No one type was so desirable as to exclude consideration of the others.

Head Space.

The experiments seem to indicate that a head space after thawing of not more than one-half to three-quarters of an inch from the top of the container is satisfactory, the space varying with the type and shape of the package. There is less possibility of a slack fill when syrup packs are used, because there is invariably less volume shrinkage.

Repackaging in Small Containers.

The experiments did not deal with fruit repackaged from large containers in the consuming markets. Hence no positive declarations about this class of frozen pack business can be made. However, there is a belief shared by many that eventually the packing of small containers will be done best in the fruit-growing districts, where the details of a high quality pack can be attended to more readily and with perhaps greater success. Until this question is answered in experience and time, every effort should be made to ensure repackaging only under such conditions as will give a product that will attract and please the consumer. It is vital for the future of the frozen pack to emphasise at this very early stage of its development that an unsatisfactory repackaged product will have a lasting effect upon the consuming public as the first impression of an entirely new method of food preservation.

Conclusions.

In recapitulation, the experiments in a general way indicate: (1) That for small container business at the present time, the frozen packing of strawberries, raspberries, loganberries, and to some extent sour cherries, is no longer in the experimental stage; (2) that the frozen pack behaviour of blackberries and sweet cherries is not yet sufficiently understood in order to ensure consistent success; (3) that for apricots and peaches even more technical questions remain unanswered; (4) that some fruits, such as Bartlett pears and melons, do not seem suited for a frozen pack; and, finally (5), that frozen packing of vegetables should be considered at the present time entirely in the experimental stage, and should not be attempted commercially until there is no shadow of doubt that frozen pack vegetables are safe for human consumption.

The Bakers' Exhibition, 1930.

Trade exhibitions occupy a most important place in the lives of those trades which hold them, and by these exhibitions it is possible for those engaged in the trade, and also the laymen, to gain some very distinct ideas of the progress which has taken place. Probably no exhibition is more popular than the Bakers', because it presents a comprehensive display of articles consumed by the majority of people. Further, such craftsmanship and technique have been used in the production of the exhibits that the progress becomes very apparent.

The spirit of competition is apparent everywhere, and this year there have been record numbers of entries in all classes of work, both confectionery and bread-making. Generally speaking, the decorated cakes of all classes showed a much higher level of craftsmanship, so that competition for the favoured awards was very keen. The exhibits of shop window displays for the "Starkey Cup" were greater in number than ever before and of a very high standard. The awards gained by the Cadera cafés were well merited, for the excellence of their ordinary shop window displays is well known to visitors of those resorts in which this firm has a branch. In all these displays the correlation of art with decorative confectionery was very apparent, for much of the work required not only an appreciation of artistic ideas but also a sound knowledge of fundamentals. Architecture also had its place among the exhibits. Truly the confectioner of to-day is a real artist!

Among the bread exhibits competition was very keen, and with the introduction of so many commercial bread classes the interest has undoubtedly been stimulated.

The competitions for the use of English wheat flours were well contested, and it is obvious that some very good tin bread can be made with such flour, despite the pessimism of some of the older generation of bakers. This flour needs handling differently from ordinary millers' flour, but with proper care and full use of craftsmanship and skill there is a great future for the use of greater amounts of English wheat flour, provided it is available in sufficient quantities.

These exhibits occupied the bulk of the gallery. On going downstairs into the hall, there were many interesting pieces of machinery and products suitable for the use of the confectioner. With the passing of the sugar confectionery and chocolate trade exhibits to their own exhibition at Olympia, much more room became available, and so the Gilbey Hall was used for trade shows, a working bakery, and an especially fine exhibit by the Empire Marketing Board. This was a source of much interest, and was run on special lines, each colony having a section with an enquiry bureau, so that much information was readily available to enquirers.

The working bakery was equipped with electric ovens by the Artofex Company, and at one end a competition was held each day for an Empire loaf to be baked on the stand, teams from sixteen bakery schools competing for a challenge shield. At the other end students from the National Bakery School, London, were giving two demonstrations daily in the production of confectionery goods. These proved a good draw, attracting many people into the hall who otherwise might not have visited it.

Among the machinery, a new bread-slicing machine aroused great interest, and we understand that many similar machines have been installed in Liverpool and towns on the Lancashire coast. The output of these machines is tremendous, and the sliced bread produced looked most appetising. Bread-wrapping machines were also to the fore, and one which worked in conjunction with the slicer contained some new features, making it possible for the sliced loaf to be wrapped without any special package, as was necessary in earlier machines. Oil firing was in evidence on all the oven builders' stands, and here some new features were to be seen, especially one unit, which was as near foolproof as seems possible. By means of a special locking device the burner could not be withdrawn alight, for on movement of a check wheel the oil supply was cut off. Also the ignition of the vaporised oil took place inside the furnace by means of a gas jet built into the furnace door.

Dough-mixers and cake-mixers all seem to be progressing towards one common style, with several minor differences in detail and variations of movement, but the introduction of machinery to every bakehouse seems to be almost an accomplished fact. Now the idea seems to be the introduction of more machinery to give increased production, since smaller models of machines, which up to the present have only been available for large scale production, were on view, and seemed eminently suited for the medium-sized trade.

The general impression one obtained was one of progress, and we understand that buying was keener and enquiries more numerous, so that although trade generally may be bad, there were signs that preparations for a forward development, when trade improves, were well in hand.

Trade News

Sealing Compounds.

It will be of interest to manufacturers and packers to learn of the establishment in London of a branch of Dewey and Almy Chemical Co., of Cambridge, Massachusetts, a firm whose products are to be found among a very big percentage of the tin box makers, canners, and packers in the world.

Starting immediately after the war with the avowed intention of tackling one article in worldwide demand, they selected a sealing compound used in the manufacture of sanitary cans.

In those days the three methods used were rubber rings, rubber solutions, and soldering. Rubber rings have long ago been discarded in America as being too slow and costly for quick outputs. Soldering has its obvious limitations, and for a time rubber solution run into the ends of cans before double-sealing was supreme in its quickness and general reliability for mass-production. Unfortunately, the use of benzol, which had a vaporisation temperature of between 95° and 105°, led to an incomplete drying at the can-makers' plant, and the faint residue was sufficient to give that peculiar and characteristic taint which has been accepted as a "tinny" flavour.

The first hurdle was taken by adopting as standard the finest grade of solvent, having a particularly low vaporisation temperature, and by following this with the admixture of certain ingredients which practice had found desirable in any type of rubber solution, a new product was evolved. This product, known as Dewalco, is still in use in a great many factories where the later and improved type of gasket has not yet made its way.

All benzol or solvent compounds have two serious objections. They are highly inflammable, and they are definitely toxic; in some States women are not allowed to handle the lining machines where such solvents are in use. Realising that it could only be a matter of time before a superior lining compound made its appearance, experiments were carried out in which rubber Latex instead of milled smoked rubber formed the base, and from these experiments there has arisen a series of water emulsions patented throughout the world and sold under the trade name of Gold Seal Lining Compound. This Gold Seal Lining Compound is made in varying degrees of concentration to suit the properties of certain types of lining machines, and in different qualities according to the nature of the pack. There are two main classes—the one being for packs containing oils or solvents, and the other for water base, such as preserved fruits. The extent to which this trade has grown is demonstrated by the fact that last year nearly five thousand million cans were sealed with Gold Seal Lining Compound.

Photomicrograph of a typical Gold Seal Film to show how the correct quantity of rubber to give a uniform gasket, resistant to ageing and shrinkage, has allowed the seaming rolls to tuck the cover hook and the body hook tightly together and iron the seam flat and smooth. It is difficult, if not impossible, to obtain such good results with a rubber ring or paper gasket seam.

Having attained a high standard in the sealing of tin containers the next step was to cater for the packer who used glass, china, or other non-metallic containers, and a series of cap-compounds was marketed to act as a means of sealing different packs. The feature of this class of compound is that it is flowed in a groove in the cap, then dried, and can be stored indefinitely without the least danger of deterioration, and that it can be fixed in the cap very much more rapidly than any type of rubber ring. At the present moment a special high speed automatic lining machine is being developed in which from 250 to 300 caps per minute can be lined.

There are other applications of the products made by Dewey and Almy, Ltd., to which there is no need for reference here. For some years sales of lining compounds and special applying machines were conducted through agents who have built up cordial business relationships. The establishment of two large groups of can makers in England, and the new and varied interests which recent developments have opened up make it imperative for the sales in England to be carried out by men who have had training in their own laboratory and factories in America, and it is essential that any manufactures of the products turned out at this new factory should have the same rigid control as is exercised in each of their other establishments.

For a time, at least, and until equipment is installed, the activities in Dewey and Almy's new London factory will be limited to the sale of stocks imported for the purpose through one or other of their manufacturing centres.

* * *

Glass Containers' Association.

The Glass Containers' Association of America held its semi-annual meeting at Atlantic City, New Jersey, on September 17, 18, and 19. Sessions were held by the publicity and research committees, and numerous addresses were given on advertising and publicity, research, transport, public relations, new and increased uses of glass containers, and other matters of importance.

* * *

Battersea Polytechnic.

The 1930-1931 session of the Chemical Department of the Battersea Polytechnic, Battersea Park Road, London, S.W. 11, opened on September 18. We note that Hugh Griffiths, B.Sc., A.R.C.S., continues with his excellent course on Chemical Engineering, and that R. H. Coysh, M.Sc., F.I.C., is giving special advanced courses on the Analysis and Microscopy of Foods and Drugs. Other courses of interest are those relating to Bacteriology (A. Sciver, B.Sc., A.I.C.), Soaps and Detergents (W. H. Simmons, B.Sc., F.I.C.), and Physical Chemistry (C. W. Davies, M.Sc., A.I.C.).

* * *

Northampton Polytechnic.

We have received the syllabus of evening courses in Electrical Engineering for the 1930-1931 session, which commences on September 22, at the Northampton Polytechnic Institute, St. John Street, London, E.C. 1.

* * *

Hackney Institute Chemical Department.

The L.C.C. Hackney Institute, Dalston Lane, London, E. 8, is inaugurating a special evening course on Modern Methods of Analysis. This course should prove of great interest and value

to practical chemists who require a knowledge of the principles of the newer methods which are finding ever-increasing application in analysis. The course includes both lectures and laboratory work. We note that optical, electrical, micro, and biological methods are embraced. The course was opened by A. C. Chapman, F.R.S., on September 24. Subsequent lectures will be given by Dr. J. Grant.

* * *

Laboratory Fittings.

Messrs. A. Gallenkamp and Co., Ltd., London, have recently issued a revised catalogue (List F.) of laboratory fittings. This is a fully illustrated and complete guide to all manner of fittings required for the laboratory, and will prove of the greatest assistance to manufacturers and chemists. Prices are given.

* * *

Drayton Equipment.

The Drayton Regulator and Instrument Co., Ltd., have issued particulars of their Pressure Operated Electric Switches, Thermostatic Electric Switches, Dial Thermometers, and their Expansion Tank Eliminators.

* * *

Biscuit Cutting and Embossing Machine.

In collaboration with Mr. Thos. L. Green, Messrs. Baker Perkins, Ltd., have now designed and put into successful operation a machine which is a radical departure from old engineering practice, and which has changed, once and for all, the possibilities and the cost of biscuit production. The Baker-Green machine cuts and pans ordinary biscuits at a speed of 240 rows per minute and embosses and pans at 160 strokes per minute.

The biscuit cutting and embossing machine is the item in factory equipment which has shown the least change through the otherwise changing years. The oven was revolutionised by the successful introduction of gas-heating; methods of mixing and sheeting have changed, and the handling of the finished product is very different from what it was twenty years ago. Meanwhile, the biscuit trade has grown out of all knowledge, and the character of the output has changed. The desire of the progressive manufacturer for units of production of greater capacity to meet the greater demand has been thwarted by the apparent necessity of keeping to the old-established methods of cutting and embossing. The dough moved intermittently under the cutter. If the biscuit were to be embossed, the mechanical principle which was deemed to be correct demanded a slow pressure upon the dough, a rest in the cutter cup for the design to be set, and a fairly quick release. The intermittent motion of the dough necessitated a similar movement in placing the biscuits on the pans, and no ingenuity could prevent an awkward jarring if any attempt were made to run the machine at high speeds.

* * *

Rapid Cutting Machine.

The Morton Machine Co. make several types of a particularly rapid and efficient cutting, garnishing, and crumbling machine for all kinds of fruits and vegetables.

* * *

Confectioners' and Bakers' Exhibition.

Mr. H. S. Rogers, the manager and secretary of the Trades' Markets and Exhibitions, Ltd., 11, Queen Victoria Street, London, E.C. 4., desires to express congratulations to all concerned with the recent exhibition, and to thank those friends in the Trade who have again done so much to make this exhibition such a success.

Mr. Rogers will shortly communicate with exhibitors or their representatives regarding space for 1931, and he wishes exhibitors as soon as possible to let him know their requirements.

Buenos Aires British Empire Trade Exhibition.

Owing to the greatly increased importance now assumed by the British Empire Exhibition to be held at Buenos Aires in March and April, 1931, His Majesty's Government have decided to treble the sum to be expended on their official participation in the Exhibition. This large increase will allow a considerable part of the impressive British Government exhibits now being shown in the Antwerp Exhibition to be sent out and adequately displayed at Buenos Aires. The Management of the Buenos Aires Exhibition have placed one of the finest buildings in their grounds at the disposal of the British Government, and the decorations of this hall and the arrangement of the exhibits will be in the hands of the Department of Overseas Trade.

The desire of British manufacturers to exhibit in the Trade Sections of the exhibition has been so great that it has been found necessary to provide more than double the covered space originally designed—and although the grounds and buildings cover more than twenty-five acres it will be difficult to fit in all who wish to participate.

* * *

Dairy Show.

At the forthcoming Dairy Show, October 21-24, Messrs. J. and E. Hall, Ltd., of Dartford, will display (Stand 100, Main Hall) a working exhibit of a "Hallmark" Dairy Plant, consisting of a three-cylinder air-cooled "Hallmark" automatic refrigerating machine arranged to cool a sectional cold chamber and provide a supply of cool brine for a tubular type milk cooler. The second exhibit, an ice-cream conservator of two-hole pattern, will have the automatic "Hallmark" refrigerating machine enclosed within the casing. A number of "Hallmark" refrigerating units will also be on view. These will be of types specially suitable for dairies and ice-cream manufacturers. In view of the success of the twin-cylinder "Wembley" machine, exhibited last year, there is to be a new and larger twin-cylinder "Wembley" ammonia machine, direct coupled to an electric motor.

* * *

Fresh Meat Act (April 15, 1930).

The Agricultural Produce (Fresh Meat) Act, 1930, has been issued by the Irish Free State as a booklet of ninety-one pages, printed in both Irish and English. This may be obtained from Messrs. Eason and Son, Ltd., 40 and 41, Lower O'Connell Street, Dublin, at the price of 1s. 3d. net.

This is defined as: "An Act to make provision for the regulation of the export of fresh meat and offals with a view to improving the general standard thereof, and for that purpose to make provision for the registration and control of premises used for the slaughter of animals or for the preparation and packing of fresh meat and offals intended for export, the licensing of persons engaged in exporting fresh meat and offals and the examination and certification of fresh meat and offals intended for export, to make provision for the proper packing of dead rabbits and dead poultry intended for export, and for other matters incidental to the matters aforesaid."

* * *

Merchandise Marks Act, 1926.

The Report on Frozen or Chilled Salmon and Trout, made by the Standing Committee set up by the Minister of Agriculture and Fisheries, the Secretary of State for the Home Department and the Secretary of State for Scotland, acting jointly, has now been presented.

Copies of this Report can be purchased from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C. 2; 120, George Street, Edinburgh; York Street, Manchester; or 1, St. Andrew's Crescent, Cardiff; or through any bookseller.

* * *

Export of Livestock to Northern Ireland.

Relaxation of requirements.—The Ministry of Agriculture for Northern Ireland announces that in view of the continued freedom of Great Britain from foot-and-mouth disease the following regulations will apply as from September 1, 1930:

1. The Ministry will be prepared to consider applications for permits to import breeding animals direct from farms or

from sales in Great Britain previously approved by the Ministry to farms in Northern Ireland. Before the issue of any permit the Ministry will satisfy itself as to the health of the animals to be imported and as to the freedom from disease of the district from which the animals are to come. On arrival in Northern Ireland animals will have to be isolated on the importer's premises for a period of fourteen days, or, in the case of swine, twenty-eight days.

2. Special arrangements have been made for the importation of breeding sheep from certain of the forthcoming autumn sheep sales in Scotland. Persons interested should communicate with the secretary to the Ministry at 25, Wellington Place, Belfast.

The above arrangements are subject to immediate cancellation or modification if, in the opinion of the Ministry of Agriculture for Northern Ireland, the disease position in Great Britain makes such action desirable. Furthermore, the Ministry reserves the right to refuse to grant an import permit in any particular case. [Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W. 1, September 3, 1930.]

* * *

Better Labelling.

We have received from the Dewey and Almy Chemical Co. a booklet, compiled by H. C. Pearson, of Massachusetts Institute of Technology, which gives useful and interesting information on a number of important matters connected with labels and labelling. First, the functions of labels are discussed (identification value, appearance, and memory value), and then this section is followed by several chapters dealing with the composition and properties of various adhesives, the defects commonly encountered, and advice as to the choice of adhesives and their application to obtain the most permanent and pleasing results.

* * *

National Institute for Dairying.

We have received the Annual Report (1929) of the National Institute for Research in Dairying, University of Reading. This reviews the past work carried out at the Institute and gives particulars of the work planned for the future. Section II. of the Report gives a detailed account of the activities of the various departments, and is of great value to all interested in the development of the dairying industry. The summary of papers published during the period August, 1928, to July, 1929, is useful. Altogether, it is quite clear that the Reading Institute is a great national asset and that the dairying industry is tremendously indebted to Professor R. Stenhouse Williams and his staff for the valuable services they have rendered. Certainly there is no other branch of the foodstuffs industry which is able to show anything approaching the same degree of efficiency and advancement in applied research. We advise canners, packers, jam-makers, and so on to see for themselves what is being done at Reading. Where can one find a better model or a finer source of inspiration?

London Gazette Information

MERCHANDISE MARKS ACT, 1926.

IMPORTED BUTTER

It is announced that an application for an Order in Council under the above-mentioned Act, to require the marking of imported butter (including blends of butter consisting of or containing imported butter) with an indication of origin, has been referred for enquiry to the Standing Committee set up under the Act by the Minister of Agriculture and Fisheries, the Secretary of State for the Home Department, and the Secretary of State for Scotland, acting jointly.

Attention is called to the fact that, under the provisions of the Act, while the Committee in every case referred to them must consider whether the goods shall bear the indication of origin at the time of sale or exposure for sale, they may also, at their discretion, consider and report upon the question whether such goods should bear an indication of origin at the time of importation.

The date of this enquiry will be announced later. Any communication with regard to the matter should, however, be addressed as early as possible to Mr. H. J. Johns, the Secretary of the Standing Committee, 10, Whitehall Place, London, S.W. 1.

REPORT OF THE STANDING COMMITTEE ON FROZEN OR CHILLED SALMON AND TROUT

The Report on Frozen or Chilled Salmon and Trout, made by the Standing Committee set up by the Minister of Agriculture and Fisheries, the Secretary of State for the Home Department, and the Secretary of State for Scotland, acting jointly, has now been presented.

Copies of this report can be purchased from His Majesty's Stationery Offices or through any bookseller.

Enquiries

132. A firm in Milan are anxious to get into touch with the manufacturers of plant in England suitable for concentrating wine by the cold process, and also a plant for concentration of lemon and lime juice.

133. Name of firms supplying powdered malt and cerelose required.

134. We are interested in the manufacture of gravy powders and gravy salt, and wish to get into touch with an expert who can supply formulæ and other information regarding the same.

135. We are making uncooked mincemeat, and desire information on questions of fermentation.

136. Names of firms supplying devices for easily opening tin containers urgently required.

137. Information relating to the manufacture of beef cubes required.

138. Recipe wanted for manufacture of café au lait.

(*Continued from page 293.*)

temperature is shown at the top of the graph. It will be seen that the temperature in the tin continues to rise, even after the tin is removed from the bath; yet the maximum temperature is well under the temperature of the muriate bath.

Sufficient has been said to show how important it is to understand, thoroughly, the character of the material to be preserved, and that food preservation by heat treatment does not consist only of placing the material in containers, and then these into retorts, without observance of the various considerations discussed above. Food preservation is a scientific subject, and as such needs the co-operation of science to make a success of it.

FOOD MANUFACTURE is sent to any address in the World for 10s. per annum. Send your subscription now to LEONARD HILL, LTD., Thanet House, 231-2, Strand, London, W.C. 2.

Abstracts and Reviews

Springers, Hydrogen Swells, and Perforations in Canned Fruits.

By F. HIRST and W. B. ADAM. *Canners' Bulletin*, No. 1. University of Bristol Research Station, Campden, Gloucestershire. Issued May, 1930.

The authors of this Bulletin—both of whom are well known for their valuable services to British canning practice—are to be most heartily congratulated on having produced two reports (Bulletin No. 2 is noted below) which, by reason of their detailed and comprehensive character and because the results of the investigations recorded are based on home conditions, mark an important advance in British canning. Already there is, in fact, evidence that the information contained in these Bulletins is being profitably utilised by the industry. We have long hoped that investigations of this kind by competent authorities would be placed at the disposal of the industry: now that so excellent a beginning has been made, we look forward most earnestly to the speedy appearance of further Bulletins.

We have extracted, below, a part of the Introduction, and also the Summary, in order to give some idea of the scope of this first Bulletin.

When dealing with canned fruit, blown cans may result from causes of two quite different types.

The first type is due to the formation of gas in the cans as the result of the growth of micro-organisms, and is brought about by the under-sterilisation of the fruit or the use of faulty cans. As acid fruits are easily sterilised, the most frequent cause of this type of blown can is an original fault in the can or an unsatisfactory seam. Under these circumstances, yeasts may gain access to the can after sterilisation, and may cause them to become blown through the formation of carbon dioxide as a result of fermentation of the sugars.

The second type of blown can results from gas production associated with the corrosion of the tinplate by the fruit acids. This may be localised, and cause perforation of the cans, or it may be of a more general nature, causing the evolution of hydrogen, which eventually leads to doming of the ends of the cans. Some cans are bulged only at one end, and when this end is pressed it springs back and the other end becomes convex. These cans are known in the trade as *springers*. When more hydrogen is present, the can is convex at both ends, and the pressure inside is such that it is not possible to press the ends into their normal shape. These are known as *swells* or *hydrogen swells*. As the distributor expects the ends of the can to be flat or concave, any can with a convex end is rejected as unsound. Hydrogen swells often develop small perforations where the metal of the can has been eaten through by the fruit acids. In some cases, however, perforations may result without the formation of hydrogen.

Thus we have three types of unsound cans which are due to the chemical action of the fruit on the metal of the can—namely, springers, hydrogen swells and perforations. Domed cans of this type would be rejected by the distributor, yet the contents when examined would be found to be sterile and the fruit in good condition. It should always be borne in mind that all canned fruit, even when properly sealed and sterilised, is eventually perishable, but the perishable article is, in fact, the can and not the fruit.

Up to the present, canners in this country have not suffered great losses from springers, hydrogen swells, or perforations. In America, however, where the canning industry has been established for a longer time, and where storage temperatures are often higher than in England, extremely heavy losses have occurred, and as a result a great amount of research work has been undertaken on this problem. When canners in this country attempt to develop an export trade to the hotter parts of the Empire, they may find a large proportion of their cans rejected by the health officials at the ports at which the cans are landed. As an example of this, two firms last year exported canned fruits, in the one case to India and Rangoon, and in the other to West Africa, and the following figures were submitted by them to the Research Station:

1.		2.	
Fruit.	*Rejected.*	*Fruit.*	*Rejected.*
Loganberries ...	14·0%	Loganberries ...	4·0%
Plums ...	15·0%	Strawberries ...	25·0%
Greengages ...	6·0%	Black Currants ...	50·0%
Strawberries ...	4·5%	Raspberries ...	4·0%
Blackberries ...	6·0%		
Damsons ...	1·5%		
Black Currants ...	16·0%		
Raspberries ...	3·0%		

It will thus be apparent that English canners who hope to extend their trade to tropical countries will have to pay particular attention to domed cans, due to this type of chemical action. Moreover, if firms who can fruit only for the home trade have to hold their stocks over a year, they will also find a certain percentage of blown cans arising from the same cause.

Although the research workers in America and in this country have not yet been successful in solving the problems, many interesting facts have been discovered, which, though in themselves small, when taken together have an important bearing upon this question.

This Bulletin, reviewing the results of research work carried out in America and England, has therefore been prepared for the benefit of the rapidly developing industry in this country.

Summary

How can the canner best guard against loss from springers, hydrogen swells, and perforations?

1. By using a well-lacquered can as free as possible from scratches. (An unlacquered can is in many ways preferable as regards reduction of loss from hydrogen swells, but it is essential to use a lacquered can to preserve the natural colour of the red and purple fruits.)
2. By the addition of a small quantity of citric acid to the syrup when canning fruits low in acid, such as bilberries, cherries, blackberries, greengages, and strawberries.
3. By giving the fruit an efficient heat exhaust before seaming.
4. By leaving a satisfactory headspace (about $\frac{1}{8}$in.).
5. By closing the cans at as high a temperature as possible, thus ensuring a good vacuum in the can.
6. By careful handling of the cans before and during processing to prevent scratching and denting.
7. By cooling the cans sufficiently before stacking (the cans will dry off if they are cooled till just warm to the hand).
8. By storing the cans under as cool conditions as possible. This is the most important factor over which the canner can exercise control.

The Use of Sugar Syrups in Fruit Canning

By F. HIRST and W. B. ADAM. *Canners' Bulletin*, No. 2. University of Bristol Research Station, Campden, Gloucestershire. Issued June, 1930.

The following is extracted from the Introduction of Bulletin No. 2, which, after discussing in a general way the use of sugar syrups in fruit canning and their density, proceeds to a detailed consideration of practical matters relating to the various forms of hydrometers, density measurement and temperature correction, practical value of density measurements, and the effect of sugar on final density—including variation in density of syrup used, variation in ratio of fruit to syrup used, and variation in head space. Some extremely useful tables are given.

The word "sugar" in its chemical sense is understood to cover a large class of compounds of very similar composition, but the only member of this class with which we are concerned in dealing with syrups for canning is the sugar known as Sucrose. Commercial granulated sugar is a substance of a very high degree of purity, generally containing over 99·5 per cent. of sucrose. The sugars obtained from the beet and sugar cane are identical, and the commercial products only differ in regard to the composition of very slight traces of impurities. There appears to be a certain amount of prejudice against the use of beet sugar for canning, but experiments carried out at Campden have shown conclusively that beet sugar is quite as satisfactory as cane from every point of view. Moreover, laboratory scale experiments carried out by Morris and Bryan appear to indicate that beet sugar contains traces of some substance which inhibits corrosion of the can by the fruit acids, and if these results are confirmed in actual canning practice, beet sugar is likely to be used in preference to cane.

The first and most obvious reason for adding sugar to canned fruits is on account of its sweetening properties, and in this respect the amount of sugar required is largely a matter of taste. The more acid fruits will, however, require stronger syrups than the fruits low in acid.

Apart from its action in sweetening the product, the addition of sugar is of advantage in certain other respects:

(*a*) It helps to retain the natural flavour of the fruit provided the sugar syrup is not too strong. Very strong syrups actually tend to mask the fresh fruit flavour.

(*b*) It assists in preserving the full rich colour of certain fruits. The natural colouring matters of red and purple fruits are more stable in sugar syrup than in water, and consequently the colour of raspberries, loganberries, etc., canned in a sugar syrup of, say, 45° to 50° Brix, is much better than that of the same fruits canned in water.

(*c*) Sugar syrup toughens the tissues of the fruit to a certain extent, and on this account renders the fruit less liable to damage during processing. Fruit canned in syrup generally travels better than fruit canned in water.

The sugar is dissolved in water to give the requisite density of syrup, and the water used should be of good drinking quality, free from any suspicion of sewage contamination, and low in mineral salts. If water with a high degree of temporary hardness is used for making syrup, the latter may become cloudy after the cans are processed.

The syrup is generally prepared in enamel-lined or copper tanks. If vessels of the former type are used, they are fitted with a steam coil, whereas copper vessels may have a coil or be steam jacketed. The syrup should be clarified by passing it through thick flannel, muslin, or fine brass wire gauze before it is used.

Density of Syrups.

The most satisfactory syrup to use is one in which the sweetness is sufficient to bring out the full flavour of the fruit without making the product too sweet. It should be remembered that the natural acidity of the fruit plays an important part in determining the flavour of the canned product, and the acidity of any particular variety of fruit will depend on its state of maturity. Generally speaking, the most acid fruits require the most sugar, but it is not possible to lay down standards for syrups which will provide for the variations in ripeness and size of the fruits which are commonly canned in England. The quantities of sugar given in the following table, have, however, been found to bring out the fresh fruit flavour, and to be sweet enough for the average palate:

Fruit.	*Lbs. Sugar per Gallon of Water.*	*Fruit.*	*Lbs. Sugar per Gallon of Water.*
Gooseberries ...	... 6 to 8	Plums and Damsons	6 to 8
Raspberries ...	... 8 „ 10	Cherries ...	... 6 „ 8
Loganberries ...	... 8 „ 12	Black Currants	... 8 „ 10
Strawberries ...	... 8 „ 10	Pears ...	... 6 „ 8
Blackberries ...	... 6 „ 8	Apples ...	... water.

In making the syrup, a weighed quantity of sugar is dissolved in a definite volume of water, and heat—generally in the form of steam—is applied to get the sugar quickly into solution. During this heating process a small amount of water may be evaporated, and if the syrup is kept hot whilst it is being used it may be further concentrated. In modern canneries the syruping machine ensures that all the cans are filled to the same level, and thus if the syrup used is constant in density and the cans contain approximately the same weight of fruit, the pack should be fairly uniform. In actual practice, however, uniformity is not always obtained, and samples of canned fruit supposed to be identical have been found when examined to vary greatly. In many cases this is due to lack of care in making the syrup. To obtain quality in canned fruit, a reasonable measure of uniformity, not only in the grading of the fruit but also in the sweetness of the product, is essential. Mistakes may occur in weighing the sugar: the correct quantity of water may not be added, or a stoppage in the canning operations may cause excessive evaporation to take place. By taking the density of the syrup periodically during the day, these faults could be corrected, provided the person in charge clearly understood the scale of density measurement employed. This Bulletin has been written with the object of supplying practical information on the subject.

Bacteriological Control in Commercial Canning

E. J. CAMERON AND H. M. LOOMIS, *Amer. Journ. Pub. Health*, 1930, Vol. 20, July, pp. 741-746.

This paper gives an account of the difficulties of sterilisation or "processing" in connection with the canning industry.

It points out that the general spoilage problem, which in non-acid vegetables arises largely from the activity of thermophilic bacteria, requires special treatment. The bacteria, by reason of the great resistance of their spores, may in the event of high contamination resist any practicable process. To cover all possible situations, so severe a process would be required as to exert detrimental effect on the product. The use of recommended processes will prevent spoilage where only a moderate degree of thermophilic contamination exists, but not be protective where contamination is unusually high.

It was therefore realised that it would be fundamentally wrong to place total reliance on sterilisation without considering the question of degree of initial contamination. Consequently, attention is drawn to the important question of prevention in reducing such contaminations. Towards this end extensive studies have been made on the known types or groups of spoilage bacteria, their sources, and the reasons for marked fluctuations in contamination.

In the spoilage of non-acid vegetables, four well-defined groups are described which have a common characteristic—namely, the ability to form spores highly resistant to heat. Extensive field studies were made on the distribution of these spoilage bacteria in order to gain information relating to the sources of spoilage organisms, and conditions under which they may multiply to such an extent as to constitute a "processing" hazard, and methods for keeping the initial contamination as low as possible.

The results showed definitely that the development of thermophilic contamination takes place largely in the cannery itself. The raw product as it comes from the field, or subsequently, is not the source of infection. Many ways have been tried to induce growth of thermophilic spoilage types in the raw product, but with no success. Refined sugar was proved an outstanding source of thermophilic spoilage bacteria.

The problem has been to apply these routine methods of examination over a wide range of territory. A field laboratory has therefore been installed in a motor-truck. Samples are collected from surrounding factories, iced and brought to the laboratory. Certain samples are taken from cans just before they have been sealed and before they are sterilised. These cans give an idea of what has taken place in the cannery in the way of infecting the food. Other samples are taken from various "key" points, such as the brine tanks, conveyors, and blanchers, so that if contamination in the canned product is higher than it should be the source may be traced.

Financial News

The Editor cannot accept responsibility for any errors which may appear in the Financial News Section

BANK RATE (1929-1930)

1929.		1930.	
Feb. 7	5½ per cent.	Feb. 6	4½ per cent.
Sept. 26	6½ ,, ,,	Mar. 6	4 ,, ,,
Oct. 31	6 ,, ,,	,, 20	3½ ,, ,,
Nov. 21	5½ ,, ,,	May 1	3 ,, ,,
Dec. 12	5 ,, ,,		

During the past year monetary difficulties retarded the free operation of economic self-adjustment, and apart from the customary seasonal fluctuations the general tendency of food prices was downward. By the grouping of associated companies, and the employment of more efficient equipment and plant units, some food manufacturing concerns were able to protect their profits, but until such time as prices have become stabilised no general revival of trade can be expected.

After providing for depreciation and income tax, and charging the sum of £2,555 for debenture interest, the net profit realised by **Holbrooks, Ltd.,** for the year ended March last was £68,803 as compared with £67,171 for the previous twelve months. Consequently the dividend of 10% and the bonus of 10% on the company's ordinary share capital has been maintained, the final appropriation account being made up as follows:

	£	£
Brought forward from 1928-1929	20,724	
Net Profit, year ended March 31, 1930 ...	68,803	
Available Balance	£89,527	
5% dividend on £70,000 Cumulative Preference £5 Shares, less tax		2,046
20% dividend on £300,000 Ordinary 5s. Shares, tax free		60,000
Transferred to Reserve		6,000
Carried forward to 1930-1931		20,581
		£80,527

The principal assets and liabilities are:

	£
Goodwill, Trade Marks, etc.	34,145
Freehold Property	127,804
Shares in Subsidiary	100,000
Due from Subsidiary	21,449
Trade and Other Investments	223,875
Stocks	43,055
Sundry Debtors	12,264
Cash	37,958
Sundry Creditors, including Provision for Contingencies	55,591
Reserve Fund	52,000

At the recent price of 78 the 4½% debenture stock gives a return of 5½%, and the preference shares at 4 yield 6¼%. During 1929 the 5s. ordinary shares reached 19s. 6d., and were recently quoted at 15s. 9d.

In March, 1928, **Vitamins (1928), Ltd.,** was registered for the purpose of acquiring the process and manufacturing rights of "Bemax" and other cereal products for human consumption, and at March 31, 1929, there was a debit balance of £10,229 to profit and loss. During the year which ended at March 31 last, a trading profit of £13,930 was realised, thereby converting the debit balance into a credit balance of £3,701. After providing for the payment of arrears of debenture interest to March 31, 1929, there remained a balance of £14 which has been transferred to the debenture interest suspense account. The authorised capital of the company is £55,000 of which £51,200 shares of 1s. each have been issued and paid up. The directors are entitled to 5% of the distributable profits for each financial period in excess of 20% per annum on the issued share capital.

The trading profit realised by **Spiers and Pond, Ltd.,** during the past accounting period aggregated £126,626, and an analysis of the final figures shows the appropriation account to be composed of the following:

	£	£
Brought forward from 1928-1929	6,246	
Net Profit, year ended March 31, 1930 ...	108,438	
	£114,684	
6½% dividend on £407,558 Cumulative Preference £1 Shares		32,341
15% dividend on £415,561 Ordinary 10s. Shares ...		62,333
Transferred to Reserve		5,000
Additional Directors' Fees		5,000
To Sickness and Benevolent Fund		3,000
Carried forward to 1930-1931		7,010
		£114,684

The company's assets and liabilities at the close of the last two financial years compare as under:

	March 31, 1930.	*March* 31, 1929.
	£	£
Shares in Subsidiaries	112,647	37,563
Government Securities	58,117	91,546
Sundry Investments	19,781	24,194
Cash	49,053	64,070
Stocks	115,669	124,697
Debtors	58,054	62,053
Creditors	126,109	138,981
5% Debentures	412,855	423,550

The preference shares were recently quoted at 19s. 9d. and the ordinary at 14s. 3d. At 95 the debentures yield 5¼%.

The net profit realised by **Clark's Bread Co., Ltd.,** millers, corn and flour merchants, and manufacturers of bread and confectionery for the wholesale and retail trade, amounted to £15,813 for the financial year which closed on March 29 last, which amount compares with £16,418 realised during the previous fifteen months, and to which was added the sum of £7,540 left over after the 1928-1929 appropriation. The payment of a final dividend of 7½% made 15% for the year, as against 17½% last time, and after transferring £1,950 to taxation reserve, the directors proposed to capitalise the sum of £5,500 of undivided profits by way of a bonus to be distributed amongst the shareholders in proportion of one share per ten held. This will leave £9,625 to be carried forward to the next profit and loss account. Recently the shares, which are of 10s. denomination, were quoted at 20s. 6d.

Plasmon, Ltd., was registered in 1900 to acquire patents for manufacturing and selling "Plasmon" food, the authorised capital being £64,000, of which £58,500 has been issued and paid up comprising £24,500 preference shares of £1, and £34,000 ordinary shares of 4s. During the year ended March 31 last, a net loss of £6,465 was sustained, and it was found necessary to transfer the sum of £10,000 from the reserve, resulting in a credit balance of £3,535 to which must be added £5,269 left over from the previous appropriation, giving a disposable balance of £8,804. Out of this surplus a dividend of 6% is being paid to the preference shareholders, absorbing £1,470, the balance of £7,334 being carried forward to the next account.

At March 31 last, the amount standing to the credit of the profit and loss account of **Sawers, Ltd.**, fishmongers, poulterers, butchers, etc., of Glasgow, was £23,630, and this sum has been apportioned in the manner shown below:

	£
5% dividend on £85,000 Cumulative Preference £1 Shares	4,250
Interim dividend of 4% on £100,000 Ordinary £1 Shares, paid in December, 1929	4,000
Final dividend of 4% on the Ordinary Shares, making 8%	4,000
Bonus of 2½% on Ordinary Shares	2,500
Written off book value of Goodwill	3,000
Depreciation of Properties	2,500
Allocated to Employés Fund	150
Carried forward to 1930-1931	3,230
	£23,630

In 1922 the company acquired the entire issued share capital of **Johnston Green, Ltd.**, for £6,000 in cash and £15,000 fully paid ordinary shares.

The profit and loss account of **Mellin's Food, Ltd.**, covering the financial year which closed at March 31, shows a credit balance of £5,090 which compares with a net profit of £8,295 realised by the company during the previous twelve months. After adding the sum of £14,404 brought forward from the last appropriation, and debiting the dividend on the 6% cumulative preference shares, £12,227 is to be carried forward to the 1930-1931 account. The preference shares were recently quoted at $\frac{7}{16}$

Production at the beet sugar factory at Wissington, Norfolk, belonging to **British Sugar Manufacturers, Ltd.**, commenced in December, 1925, and at March 31, 1929, there was a debit balance of £59,532. During the year which terminated in March last, the receipts aggregated £363,541 as compared with a total of £292,020 the previous year, the general expenses amounting to £270,977 as against £222,166. The net profit was computed at £46,537, out of which it is proposed to write off £30,000 under the heading of depreciation, and to allocate £1,000 to bridge suspense account, the balance of £15,537 being utilised to reduce the debit balance to £43,995. The authorised capital of the company is £350,000 in £1 shares.

The audited profit and loss account of **McEnnery Bros., Ltd.**, tea, wine, and spirit merchants, and manufacturers of cordials and liqueurs, etc., covering the financial year to April 30 last shows a credit balance of £892, representing the amount of net profit realised. After transferring £1,500 from the reserve, and £176 from taxation account, and paying the dividend on the preference shares, the sum of £63 will be carried forward to the next account. Last year £1,000 was transferred from reserve, which will now show a balance of £7,500.

The scheme for the reoganisation of the **British Feeding-Meals and Milk Products, Co., Ltd.**, which was registered in 1926, and which controls **Lamina, Ltd., Hawker and Botwood, Ltd., Premier Fish Meal Co., Ltd.**, and **Belvedere Fish Guano Co., Ltd.**, provides for the reduction of the company's fully paid shares from £1 to 10s. by the cancellation of £159,187 as being unrepresented by assets. After the scheme has been sanctioned by the court, the reduced shares are to be convertible, for three months, into 6% cumulative preference shares, while it is proposed that the holders of the partly-paid shares shall pay up the outstanding call, after which the shares are to be reduced to 10s. each by cancelling 2s. of the 4s. paid up, and by cancelling 8s. of the liability. Each £1 share would then become a 10s. share with 2s. paid and 8s. remaining unpaid. The scheme is an unusual one, and will doubtless be scrutinised closely by the court. The company's profit and loss account covering the year to December last shows a debit balance of £24,596, although an interim dividend of 5% on the original issue of shares has already been paid. At December 31, 1928, the amount standing to the debit of profit and loss was £9,764.

During the year ended March 31 last, the profit realised by **McDougalls, Ltd.**, millers, corn and grain dealers, and manufacturers of self-raising flour, etc., amounted to £111,651. Last year a dividend of 6% was paid on the ordinary shares, plus a bonus of 2½%, but this year the dividend has been raised to 7% and the bonus to 3%. The following further appropriations have been made:

	£
Preliminary Expenses written off	8,000
Transferred to Advertising Reserve	15,000
Allocated to Taxation Reserve	5,000
To General Reserve	20,000
Staff Bonuses	3,293

The preliminary expenses have now been extinguished, and the general reserve brought up to £65,000.

The balance of net profit realised by **J. Lyons and Co., Ltd.**, during the year ended March 31 last was £935,871, as compared with a net profit of £908,950 during 1928-1929. The sum of £42,308 was left over from the previous appropriation, but out of this a transfer of £25,000 has since been made to the reserve, leaving £17,308 to be added to the 1929-1930 profit figure. The available balance was therefore £953,178, and of this sum dividends absorbed £819,953, so that after transferring another £100,000 to reserve the amount to be carried forward to the next account is £33,226. The dividend on the company's ordinary shares has been maintained at 22½%, and these shares, which reached £5 8s. 9d. in 1929, were recently quoted at 95s.

The dividend of 12½% paid last year to holders of the ordinary shares of **Hunters the Teamen, Ltd.**, has been maintained, the net profit for the financial year ended June 28 last being £56,713, which compares favourably with a balance of £55,273 realised during the previous year. To this figure of net profit must be added the sum of £12,008 which was brought in from the previous account, giving a disposable balance of £68,721, which has been distributed in the following manner:

	£
7½% dividend on £90,000 Cumulative Preference £1 Shares	6,750
7½% dividend on £114,030 Cumulative Preferred £1 Shares	8,620
12½% dividend on £230,000 Ordinary £1 Shares	28,750
Allocated to Depreciation Reserve	5,000
Transferred to General Reserve	5,000
Carried forward to 1930-1931	14,601
	£68,721

The depreciation reserve will now amount to £200,000, and the general reserve to £10,000. At Manchester the preference shares were recently quoted at 25s., the preferred at 24s., and the ordinary at 52s. 6d.

In January, 1929, **Sodax (1929), Ltd.**, was registered for the purpose of acquiring world rights in "Sodax" apparatus for the manufacture of aerated waters and in a recording device, the authorised capital of the company being £150,000 in the form of ordinary 5s. shares, of which £132,500 have been issued and called up. The first accounts covering the financial period ended March 31 last show the following principal figures:

	£
Debit to Profit and Loss Account	31,285
Preliminary Expenses	18,036
Furniture, Fixtures, etc.	354
Stock-in-Trade	8,367
Loan	12,000
5% War Loan, at cost	1,476
Cash	723
Sundry Debtors	962
Sundry Creditors	1,206
Capital Reserve (amount received on Forfeited Shares)	3,402

The **Irish Sugar Manufacturing Co., Ltd.**, was registered in December, 1925, with an authorised share capital of £4[illegible], comprising £380,000 "A" shares of £1 each, and £20,000 "B" shares of 1s. each, all of which have been issued and paid up. The final accounts are made up to June 30 each year, and are usually submitted in September, and the profit realised during the year ended June 30, 1930, amounted to £66,034 as compared with £127,140 for the previous twelve months. Last year the sum of £17,716 was written off capital expenditure, £11,400 was reserved for stamp duty on share warrants, and £40,000 was transferred to reserve, but this time, after payment of a dividend of 15%, as last year, there remains a balance of

only £12,491, which has been carried forward to the next appropriation account.

An interim dividend of 2½% was paid to shareholders of **Hugon and Co., Ltd.**, on September 30, the rate being the same as that paid a year ago. The company was registered in 1920, and manufactures "Atora" refined beef suet and lard, etc., the authorised capital being £1,500,000 in £1 shares.

A special meeting of shareholders of **Vitamins (1928), Ltd.**, was called for August 27 to consider a resolution changing the name to **"Vitamins, Ltd."** The company was registered in 1928 and acquired the process and manufacturing rights of "Bemax" and other cereal products for human consumption. It owns the entire share capital of **Agricultural Food Products, Ltd.**, and controls **Agricultural Food Products (Chester), Ltd.**, and **Canadian Vitamins (1928), Ltd.**

The offer recently made to the preference shareholders of **English Margarine Works, Ltd.**, to exchange their shares for 7% cumulative preferred shares in **Unilever, Ltd.**, was accepted by over 90% of the holders, and consequently it has been decided to complete the exchange. The offer closed on August 16.

The policy of expansion which was inaugurated two years ago by the **Borden Company** has resulted in the acquisition of several complementary undertakings. The business of the subsidiary enterprises falls under the following general departmental heads: (1) Food products, (2) dairy products, (3) ice-cream, and (4) poultry. As compared with a net income of $11,354,331 in 1928, the net income during 1929 amounted to $12,403,725. At the end of 1929 current assets totalled $64,145,700, against current liabilities amounting to $20,662,400, so that the net working capital was no less than $34,483,300. After deducting an adequate sum to cover depreciation, and also a mortgage to the extent of $1,400,000, the balance of the plant account was shown on the consolidated balance-sheet at $104,530,800, while the book value of the stock was $130,176,300.

The terms of the **Unilever Provision Stores** amalgamation scheme have been based upon profits, with an equitable regard to the security of the assets and income of the amalgamating companies whose businesses (with the exception of **Lipton, Ltd.**) are to be transferred to **Allied Stores, Ltd.**, by the exchange of shares. The amalgamating companies, and dates of incorporation, are:

International Tea Company's Stores, Ltd., registered in 1895, and which controls **Kearley and Tonge, Ltd.**, and acquired, in 1929, the **Star Tea Company, Ltd.**

Home and Colonial Stores, Ltd., registered in 1895.

Lipton, Ltd., registered in 1898.

Maypole Dairy Company, Ltd., registered in 1898.

Meadow Dairy Company, Ltd., registered in 1906, and owning all the share capital of **Broughs, Ltd., Sherry's Dairy Company, Ltd.**, and **Neale's Tea Stores, Ltd.**

Pearks' Dairies, Ltd., registered in 1914 in reorganisation of **Pearks, Ltd.**, which was formed in 1898 (name changed 1904).

The existence of debenture issues renders the method of exchanging shares inapplicable to **Lipton, Ltd.**, although the shareholders are invited to exchange their shares for shares in the new amalgamating company, and assuming that all Lipton shares are exchanged, the issued capital of **Allied Stores, Ltd.**, will amount to £12,296,684, comprising £2,249,166 6% "A" cumulative £1 preference shares; £2,560,304 7% "B" cumulative £1 preference shares, £1,012,698 15% preferred £1 shares, and £6,474,516 ordinary 5s. shares.

FOOD INDUSTRY STOCK AND SHARE LIST

	Sept., 1930.	*Par Value.*	*Aug.*, 1930.
Aerated Bread: Ord. ...	18/6	£1	17/6
6½% Pref.	18/9	£1	19/-
Apollinaris: Ord.	7/10	£1	7/6
Assoc. Biscuit: 6½% Pref. ...	23/-	£1	23/-
Avery (W. and T.): Ord. ...	53/6	£1	54/6
Bovril: Ord.	24/9	£1	24/6
Deferred	30/3	£1	30/-
6% Pref.	22/-	£1	21/9
4½% Deb.	81	£100	86
British Aluminium: Ord. ...	40/-	£1	39/6
6% Pref.	21/-	£1	21/-
British Thomson Houston:			
7% Pref.	21/11	£1	22/-
Cadbury: 8% 2nd Pref. ...	27/9	£1	26/10
Carrs: 6½% Pref.	21/10	£1	20/6
Cerebos: Ord.	57	£1	51/16
Chivers: 6% Deb.	100	£100	100
Cinzano: 7½% Pref.	21/3	£1	21/9
Clark's Bread: Ord.	20/6	10/-	20/-
Crosse and Blackwell: Ord.	2/-	1/-	1/10
7½% Pref.	10/9	15/-	10/10
English Margarine: Pref. ...	22/9	£1	22/6
Foster Clark: Ord.	46/-	10/-	47/9
Fry's: 8% "B" Preferred	22/-	£1	21/10
H.P. Sauce: Ord.	66/6	£1	65/6
Hill (W.): Ord.	¾	£1	¾
Home and Colonial: Ord. ...	14/-	4/-	13/-
15% Cum. Ord.	46/3	£1	45/7
6% Cum. Pref.	5/16	£5	5/16
Hovis: 6% Cum. Pref. ...	21/10	£1	21/10
Imperial Chemical: Ord. ...	23/-	£1	20/6
Deferred	7/2	10/-	5/9
7% Cum. Pref.	23/3	£1	21/9
International Tea: Ord. ...	21/6	5/-	20/10
6% 1st Pref.	20/6	£1	20/3
7% "A" Pref.	23/-	£1	22/2
Liebigs: (Reg.)	14⅜	£5	14⅜
(Bearer)	14⅜	£5	14⅞
5% Pref.	95/-	£5	96/3
Lipton: Ord.	5/6	1/-	5/2
5% 1st Pref.	8/-	1/-	8/2
6% Pref.	8/10	10/-	9/-
6% Deb.	97	£100	96
Lyons: Ord.	95/-	£1	97/6
"A" Ord.	94/-	£1	97/6
5% Pref.	20/3	£1	19/8
6% Preferred Ord. ...	21/6	£1	21/4
7% Pref.	23/9	£1	26/6
8% Pref.	28/9	£1	27/10
Maypole Dairy:			
20% Preferred	14/-	5/-	14/6
Deferred	5/4	2/-	5/-
5% Pref.	10/6	£1	10/2
Meadow Dairy: 7½% Pref.	23/4	£1	23/3
Nathan (J.): Ord.	2/3	1/-	2/3
7% Pref.	15/9	£1	15/9
8% Preferred	8/-	10/-	8/-
Nestlés: 8% Pref.	29/8	£1	28/7
Pascall (J.): 8% Preferred	8/9	£1	10/8
Peak Frean: 5% Pref. ...	17/2	£1	17/2
8% "A" Pref.	25/3	£1	26/-
Radcliffs Edible: Ord. ...	2/2	1/-	2/2
8% Pref.	6/-	10/-	9/-
Radiation: Ord.	35/9	£1	35/3
6% Pref.	21/-	£1	22/-
Schweppes: Deferred ...	35/-	£1	34/10
4% Deb.	76	£100	75
Scribbans: Ord.	13/3	£1	12/9
Deferred	2/-	1	1/10
Smith's Potato Crisps: Ord.	9/6	5/-	8/6
Spiers and Pond: Ord. ...	14/3	10/-	16/2
6½% Pref.	19/9	£1	20/-
5% Deb.	98	£100	95
Spillers: Ord.	22/-	£1	18/9
6% Pref.	18/-	£1	18/6
Deferred	7/-	£1	5/9
Tate and Lyle: Ord. ...	41/-	£1	37/6
6½% Pref.	23/-	£1	22/10
Unilever: Ord.	53/-	£1	53/-
7% Preferred	23/6	£1	23/3
Union Cold Storage: 6% Pref.	20/4	£1	19/10
7% Pref.	21/9	£1	21/-
10% Pref.	27/1	£1	26/-
United Caterers: Ord. ...	6d.	5/-	6d.
United Dairies: Ord. ...	31/4	£1	31/-
6% Pref.	20/8	£1	20/8
United Glass Bottle: Ord. ...	21/-	£1	22/-
United Molasses: Ord. ...	37/-	£1	36/-

New Companies

ROBERT BOOTH AND SONS, LIMITED. (249965.) To take over the bus. cd. on at 236, Holderness Road, Hull, and elsewhere, as "Robert Booth," and to carry on the bus. of wholesale and retail provision mchts. and factors, etc. Nom. Cap.: £1,000 in £1 shares.

E. BREWER, LIMITED. (249949.) To take over the bus. of a grocer and provision mcht. cd. on at 10, Friargate, Preston, as "E. Brewer." Nom. Cap.: £2,000 in £1 shares (1,000 pref. and 1,000 ord.).

DUTFIELD AND SHERRINGHAM, LIMITED. (249882.) To take over the bus. of fruit, potato, and vegetable mchts. and commission agents cd. on at Castlefords Market, Sheffield, as "Dutfield and Sherringham." Nom. Cap.: £2,000 in £1 shares.

NATIONAL PRODUCTS (MIDLAND), LIMITED. (249868.) 1, Budge Row, E.C. 4. To carry on the bus. of poultry and pig farmers, dairymen, market gardeners, nurserymen, etc. Nom. Cap.: £1,000 in £1 shares.

HOSEGOODS (PLYMOUTH), LIMITED. (249888.) Dock Chambers, Great Western Docks, Plymouth. To carry on the bus. of buyers of and dlrs. in wheat, oats, barley, maize, rice, and all kinds of grain, etc. Nom. Cap.: £20,000 in £1 shares.

HEALTH MINERAL WATER COMPANY, LIMITED. (250153.) The Works, The Terrace, High Road, Kilburn, N.W. 6. To carry on the bus. of mnfrs. of and dlrs. in mineral waters, etc. Nom. Cap.: £500 in £1 shares.

OKAY FOOD PRODUCTS, LIMITED. (250090.) Birchington Road, Kilburn, N.W. 6. To carry on bus. as makers and vendors of dressed provisions, etc. Nom. Cap.: £100 in 1s. shares.

E. SYKES AND COMPANY, LIMITED. (250034.) 6, Hammerton Street, Bradford. To take over the bus. of grocers and provision mchts. cd. on at Bradford as "Sykes and Company." Nom. Cap.: £500 in £1 shares.

HARRY CUSDEN, LIMITED. (250059.) 183, Longley Road, Tooting, S.W. To take over the bus. of a grocer and provision mcht. and wine, spirit, and beer mcht. cd. on at Tooting and branches, as "Harry Cusden." Nom. Cap.: £15,000 in £1 shares (1,000 pref. and 14,000 ord.).

BRITISH AND BRAZILIAN PRODUCE COMPANY, LIMITED. (250004.) 80, Long Acre, W.C. 2. To carry on the bus. of importers and shippers of fruit and produce of all kinds, etc. Nom. Cap.: £100 in £1 shares.

WYNNE CONFECTIONERY COMPANY, LIMITED. (250018.) 1, Wynne Road, Brixton Road, S.W. 9. To mnfre. buy, and sell chocolate, cocoa, sweetstuffs, etc. Nom. Cap.: £1,000 in £1 shares.

FARLEIGHS (WINKLEIGH) STORES, LIMITED. (250037.) The Stores, Winkleigh, Devon. To take over the bus. of a grocer, provision, and gnl. mcht. cd. on by Fredk. W. Farleigh, of Winkleigh. Nom. Cap.: £2,000 in £1 shares.

UXBRIDGE FISHERIES, LIMITED. (250077.) 13-14, High Street, Uxbridge. To carry on the bus. of fishmongers, etc. Nom. Cap.: £5,000 in £1 shares.

HARRY CATCHPOLE AND COMPANY, LIMITED. (249955.) 15, Herring Market, Lowestoft. To carry on the bus. of fish mchts., etc. Nom. Cap.: £5,000 in £1 shares.

FEEDUM CATTLE AND POULTRY FOODS, LIMITED. (250292.) Ribble Bank Mills, River Street, Preston. To carry on the bus. of mnfrs. and mchts. of feeding stuffs and oilcake for cattle, poultry, etc. Nom. Cap.: £6,000 in £1 shares (2,000 pref. and 4,000 ord.).

G. PIMLOTT, LIMITED. (250294.) Queen's Buildings, Stamford New Road, Altrincham. To take over the bus. cd. on by G. Pimlott as a butcher and meat purveyor, etc. Nom. Cap.: £10,000 in £1 shares.

MAC' AND COMPANY (BLACKPOOL), LIMITED. (250169.) 71, Bond Street, South Shore, Blackpool. To establish shops and refreshment-rooms at Blackpool or elsewhere for the sale of bread, biscuits, and other farinaceous goods, etc. Nom. Cap.: £1,200 in £1 shares.

G. BLUNDELL AND SONS, LIMITED. (250242.) To take over the bus. of wholesale grocers and provision mchts. cd. on at Singleton Street, Blackpool, as "G. Blundell and Sons." Nom. Cap.: £5,000 in £1 shares.

WATFORD WAXED PAPER COMPANY, LIMITED. (250216.) 34-36, Gresham Street, E.C. To acquire the sole services of Henry B. Hart, and to carry on the bus. of paper mnfrs. and mchts., mnfrs of, and dlrs. in waxed papers and aluminium and other foil wrappers, etc. Nom. Cap.: £6,000 in 5,375 ord. shares of £1 and 2,500 defd. of 5s.

LARKINSON, LIMITED. (250268.) To take over the bus. of a wholesale and retail grocer, provn. mcht., confectioner, etc., cd. on at St. Neots, Hunts, and at Stevenage, Herts, as "F. C. Larkinson." Nom. Cap.: £5,000 in £1 shares.

A. G. BAGLEY, LIMITED. (250176.) 41 and 43, Merton Road, Watford. To carry on the bus. of farm produce mchts. cd. on by A. G. Bagley and J. F. Thompson, at 38, Bushey Mill Crescent, Watford. Nom. Cap.: £1,000 in £1 shares.

E. WHEATER AND SONS, LIMITED. (250192.) Duke Street, Rochdale. To carry on the bus. of factors of and dlrs. in corn, seed cake, oil, hay, straw, cattle food, and similar produce, etc. Nom. Cap.: £2,000 in £1 shares.

JAMES WALKER AND SONS (NEWCASTLE), LIMITED. (250343.) To take over the bus. of a spice mcht. cd. on at 14, Princess Street, Newcastle-upon-Tyne, by J. Walker. Nom. Cap.: £4,000 in £1 shares.

A. A. PARKER, LIMITED. (250328.) 65a, Oxford Street, W. To carry on the bus. of fruit, flower, and vegetable growers and dlrs., etc. Nom. Cap.: £5,000 in £1 shares.

BARNETTS, LIMITED. (250409.) 386, Whitley Road, Whitley Bay, Northumberland. To take over the bus. of a wholesale and retail wine and spirit mcht. cd. on at Whitley Bay, and at 18, Market Place, Hexham, as "W. G. Barnett." Nom. Cap.: £1,000 in £1 shares.

MIRIAM'S FOOD, LIMITED. (250560.) 76, Victoria Street, S.W. 1. To carry on the bus. of mnfg. and selling "Miriam's Food," etc., in England and elsewhere. Nom. Cap.: £2,000 in 5s. shares.

JOHN J. POWELL, LIMITED. (250505.) 16, Tempest Hey, Liverpool. To take over the bus. of a confectioner and dlr. in tobacco, cigarettes, and fancy goods cd. on at Liverpool as "Powell's." Nom. Cap.: £1,000 in £1 shares.

PENNY, JOHNSON, LIMITED. (250544.) To carry on the bus. of edible oil and fat mchts. and dlrs. in ranges and other articles used in the bus. of fish friers and public caterers cd. on at 46-50, Elswick Road, Newcastle-upon-Tyne. Nom. Cap.: £12,000 in £1 shares (1,500 pref. and 10,500 ord.).

CEREAL AND GENERAL PRODUCTS, LIMITED. (250446.) 1 and 2, Gracechurch Street, E.C. 3. To carry on the bus. of gnl. provision mchts., etc. Nom. Cap.: £3,000 in £1 shares (2,000 ord. and 1,000 deferred).

PETER SLADER AND SON, LIMITED. (250545.) To take over the bus. of a fruit and vegetable mcht. cd. on at 29, East Southernhay, Exeter; Crockwell Street, Factory Row, Torquay; July Street, Barnstaple, and Crockwell Street, Bodmin, as "Peter Slader and Son." Nom. Cap.: £10,000 in £1 shares (2,500 pref. and 7,500 ord.).

A. FOLKES AND SONS, LIMITED. (250392.) Harcourt Street, East Kirkby, Notts. To take over the bus. of chocolate and confectionery mnfrs. cd. on at East Kirkby by A. Folkes and Sons. Nom Cap.: £3,000 in £1 shares.

JAMES HUNT (ABBEY MILLS), LIMITED. (250452.) Abbey Mills, Abbey Lane, West Ham, E. 15. To carry on the bus. of flour salesmen, etc. Nom. Cap.: £100 in £1 shares.

OLD BETTY PLANT'S, LIMITED. (250517.) Morley Street, Hanley, Stoke-on-Trent. To take over the bus. of a wholesale and mnfg. confectioner and genl. mcht. cd. on at Hanley by P. Nadin. Nom. Cap.: £8,000 in £1 shares.

Current Literature

Fruit and Vegetable Products

368. Table Syrup from Grapes. W. V. Cruess and D. S. Glenn. (*Fruit Prods. J.*, 1930, August, p. 366.)
369. Relation of Grape Products to the Grape Surplus. W. V. Cruess. (*Ibid.*, p. 369.)
370. The Processing of Apricots. S. Blumenthal and L. Thuor. (*Ibid.*, p. 372.)
371. The Thickening of Foods. H. Bennett. (*Ibid.*, p. 374.)
372. Peeling Peaches for Freezing. J. G. Woodroof. (*Ibid.*, p. 375.)
373. Use of Lead Acetate in the Determination of the Acidity of Fruit Products. B. Hartmann and F. Hillig. (*J. Assoc. Off. Agric. Chem.*, 1930, p. 259.)
374. Vitamin Content of Preparations Manufactured from Fresh Fruit. F. V. von Hahn. (*Z. Unters. Lebensm.*, 1930, pp. 4 and 18.)
375. Vitamins in Canned Foods—IX. Tomato Products. Kohman, Eddy, and Zall. (*Ind. Eng. Chem.*, 1930, September, p. 1015.)
376. Loading and Unloading Retorts. J. H. Kallen. (*Canning Age*, 1930, September, p. 638.)
377. Use of Fruit Pectin in Tomato Catsup. W. A. Rooker. (*Canner*, 1930, No. 11, p 11; No. 12, p. 13.)
378. California Canning Laws and their Enforcement. M. P. Duffy. (*Canner*, 1930, No. 10, p. 13.)
379. Colour Comparator for Tomato Pulp. J. H. MacGillivray. (*Canner*, 1930, No. 8, p. 13.)
380. Packing Pimentos in Glass. W. V. Cruess. (*Ibid.*, No. 9, p. 25.)
381. Grading Peas. L. C. Mazzola. (*Food Ind.*, 1930, August, p. 340.)
382. Why Freeze Fruit in Syrup? M. A. Joslyn. (*Ibid.*, p. 350.)
383. Detection of Carrots in Marmalade. A. Hanak. (*Z. Unters. Lebensm.*, 1930, p. 513.)
384. Determination of Copper in Green Vegetables. A. Hanak. (*Ibid.*, p. 511.)
385. Acidity and Corrosion in Canned Fruits. E. Kohman and N. Sanborn. (*Ind. Eng. Chem.*, 1930, p. 615.)

Cereal Products

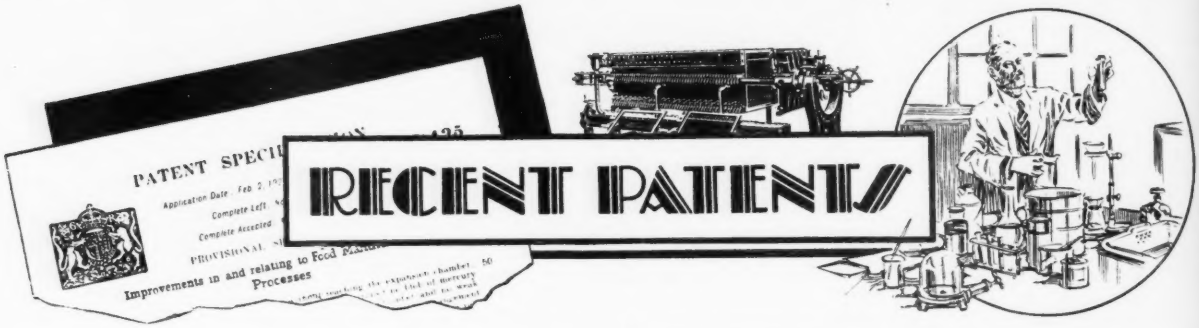
386. Application of Photography to Cereal Work. C. G. Harrel. (*Cereal Chemistry*, 1930, July, p. 313.)
387. Modification of the Swanson Mixer and its Application to the Standard Baking Test. W. L. Heald. (*Ibid.*, p. 322.)
388. An Automatic Proofing Device for Bread Doughs. T. R. Aitken. (*Ibid.*, p. 331.)
389. A Simple Apparatus for Measuring Compressibility of Baked Products. C. H. Bailey. (*Ibid.*, p. 340.)
390. A New Type of Fermentation Cabinet. C. H. Bailey. (*Ibid.*, p. 341.)
391. Calibration of Loaf Measuring Devices with Metal Models. C. H. Bailey. (*Ibid.*, p. 346.)
392. Report of the Committee on the Standard Baking Test. C. H. Bailey. (*Ibid.*, p. 348.)
393. Report of the Committee on Methods of Testing Cake and Biscuit Flours. M. Brooke. (*Ibid.*, p. 364.)
394. Report of the Committee on Methods of Analysis. J. T. Flohil. (*Ibid.*, p. 380.)
395. Report of Committee on Flour Specifications. F. A. Collatz. (*Ibid.*, p. 397.)

Dairy Products

396. Freezing Point of Milk for Detecting Added Water. G. D. Elsdon and J. R. Stubbs. (*Analyst*, 1930, p. 423.)
397. Routine Detection of Nitrates in Milk. A. F. Lerrigo. (*Ibid.*, p. 433.)
398. Effect of Adding Sodium Bicarbonate to Milk. P. Cazeneuve. (*Ann. Falsif.*, 1930, p. 303.)
399. Content of Salt in Cheese. F. Münchberg (*Milch. Zentr.*, 1930, p. 201.)
400. Determination of Egg in Ice-Cream. N. C. Smith. (*J. Assoc. Off. Agric. Chem.*, 1930, 13, p. 272.)
401. Relative Merits of Sucrose, Dextrose, and Lævulose as Used in the Preservation of Eggs by Freezing. O. M. Urbain and J. N. Miller. (*Ind. Eng. Chem.*, 1930, p. 355.)
402. An Enquiry into Some Problems Connected with Milk. C. J. Stock. (*Analyst*, 1930, September, p. 535.)
403. Examination of Milk for Tubercle Bacilli. D. R. Wood. (*Ibid.*, p. 544.)
404. Determination of Sucrose, Lactose, and Invert Sugar in Sweetened Condensed Milk. (*Ibid.*, p. 573.)

Various

405. Determination of Caffeine in Decaffeinated Coffee. W. F. Allen. (*J. Assoc. Off. Agric. Chem.*, 1930, p. 265.)
406. Control of Mineral Waters and their Salts under the Federal Food and Drugs Act. J. W. Sale. (*Ind. Eng. Chem.*, 1930, p. 332.)
407. Fumigation with Ethylene Oxide. J. M. Russ. (*Ibid.*, p. 328.)
408. The Nitrogen Industry and our Food Supply. R. E. Slade. (*J.S.C.I.*, 1930, No. 37, p. 760.)
409. Fermentation Products from Cornstalks. C. S. Boruff. (*Ind. Eng. Chem.*, 1930, September, p. 931.)
410. Grading and Packing Almonds for the Candy Industry. H. R. Habicht. (*Mfg. Conf.*, 1930, July, p. 36.)
411. After Development of Cocoa Aroma in Chocolate Coating. R. Whymper. (*Ibid.*, p. 39.)
412. Control of Raw Material in the Mayonnaise Plant. A. Epstein and B. R. Harris. (*Canner*, 1930, No. 11, p. 25.)
413. Corn Syrup Characteristics that Influence Hard Candy Quality. J. M. Krno. (*Mfg. Conf.*, 1930, August, p. 40.)
414. Colours for the Confectioner. (*Ibid.*, p. 43.)



These particulars of New Patents of interest to readers have been selected from the Official Journal of Patents, and are published by permission of the Controller of H.M. Stationery Office.

Latest Patent Applications

25590. DEBENHAM, E. R. AND HARDING, L.: Drying whey. August 27.

25554. STEWART, A. B.: Treating and packaging olives. August 27.

25320. (SWEETS LABORATORIES, INC.): Making chewing-gum base. August 25.

24907. GABEL, G.: Machines for shaking-down chocolate, etc., in moulds. August 20.

Specifications Published

333,722. BIRDSONG, J. A. AND SHOWERS, J. L.: Display stands for foodstuffs.

333,981. EWART, R. D.: Machines for extruding butter and like substances.

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, at the uniform price of 1s. each.

Abstracts Published

332,047. **Dried milk preparations.** GATES, W. R B. ST. J., TAVROGES, J., AND COW AND GATE, LTD., Stoke Road, Guildford, Surrey.

A dried milk product having laxative properties is obtained by distributing phenolphthalein in finely dispersed state through milk, or a mixture of milk with coffee, cocoa, etc., and then drying. The phenolphthalein may be dissolved in an alkaline solution—*e.g.*, aqueous sodium carbonate—and the solution added to the milk, which is stirred well so that a homogeneous mixture is obtained, the phenolphthalein being precipitated in finely dispersed condition by the acids present in the milk, the product being finally dried. In an example, 20 gm. of phenolphthalein are added to a small quantity of water in which 30 gm. of sodium carbonate have been dissolved and the solution is then added to 10 gallons of milk.

331,813. **Plucking poultry.** BINGHAM, G. C. and BINGHAM, R., The Friary, Maldon, Essex. March 6, 1929, No. 7265. [Class 28 (ii).]

331,861. **Making coffee.** BOSSI, E., 14, Eulenstrasse, Altona, Germany. April 9, 1929, No. 10967. [Class 129.]

331,880. **Synthetic fats.** HILDITCH, T. P., 32, Beresford Road, Oxton, Birkenhead. March 11, 1929, No. 7817. [Class 2 (iii).]

Esters.—Synthetic fats are produced by esterifying a mixture of fatty acids containing about $\frac{1}{3}$ to $\frac{2}{3}$ of saturated fatty acids and the balance unsaturated acids, by heating with a deficiency of glycerol and if desired under reduced pressure. A suitable mixture of fatty acids may be obtained by saponifying a vegetable fat or fats, and if necessary adding a proportion of animal fats or acids to adjust the content of saturated acids in the mixture to within the desired limits. In examples, a mixture containing specified proportions of palmitic, stearic, oleic, and linoleic acids, yields on esterification a synthetic lard; a mixture containing palmitic and oleic acids (in which some of the oleic acid may be replaced by linoleic acid) gives on esterification a fat resembling natural lard; a fat resembling tallow is produced by esterifying a mixture of palmitic, stearic, and oleic acids, in which a part of the oleic acid may be replaced by linoleic acid; the fatty acids liberated from cacao butter are recombined with glycerol, to produce a product closely resembling mutton tallow. During the esterification an excess of about 10 to 20 per cent. of fatty acid mixture is preferably employed, above that theoretically required in the reaction.

331,896. **Confectionery.** GREER, J. W., 119, Windsor Street, Cambridge, Massachusetts, U.S.A. March 4, 1929, No. 6967. [Classes 28 (i), 78 (i), and 87 (ii).].

Coating bakers', etc., goods.—Relates to bunching or spacing mechanism associated with conveyors for confections.

331,936. **Dough-dividing machines.** BELLINGROTH, F., Schnellenbach, Ründeroth, Germany. April 17, 1929, No. 11915. [Class 87 (ii).]

Recent Trade Marks

This list of Trade Marks of interest to readers has been selected from the "Official Trade Marks Journal," and is published by permission of the Controller of H.M. Stationery Office.

GOLDEN SHEAVES.—514,950. **Biscuits and cakes.** MCVITIE AND PRICE, LTD., St. Andrew Biscuit Works, Gorgie Road, Edinburgh., and The Edinburgh Biscuit Works, Harlesden, London, N.W. 10. Sept. 10.

CAFAROC.—514,323. **Coffee.** CLIFTON'S COFFEE CO., LTD., 16, Great Newport Street, London, W.C. 2. Sept. 10.

GIBRO.—513,898. **Cooked and potted meats and potted fish.** GIBSON BROTHERS (LIVERPOOL), LTD., 100 and 102, Kempston Street, Liverpool. Sept. 10. (By Consent.)

GOLD SPORT.—512,964. **Potato crisps.** SORRISO BACCI, trading as S. BACCI AND CO., 9, Bridge Street, Portadown, Northern Ireland. Sept. 10.

LARKSPUR.—513,808. **Canned fruits.** HENRY KINGHAM AND SONS, LTD., 85, High Street, Watford, Hertfordshire. Sept. 10.

SUNDALE.—514,105. **Crustless cheese.** GLENDALE DAIRY CO., LTD., 23 Station Road, Whitchurch, Shropshire. Sept. 3. (By Consent.)

LUSTRA.—513,930. **Custard powder.** THE OLASSINE CO., LTD., 82, Tunnel Avenue, East Greenwich, London, S.E. 10. Sept 3.

IVYDALE.—513,655. **Butter.** E. M. DENNY AND CO., LTD., Hibernia Chambers, London Bridge, London, S.E. 1. Sept. 3.

BOGAWANTALAWA.—499,020. **Tea.** COLONEL FREDERICK FINCH MACKENZIE, C.B., Ramslade, Bracknell, Berkshire. Sept. 3.